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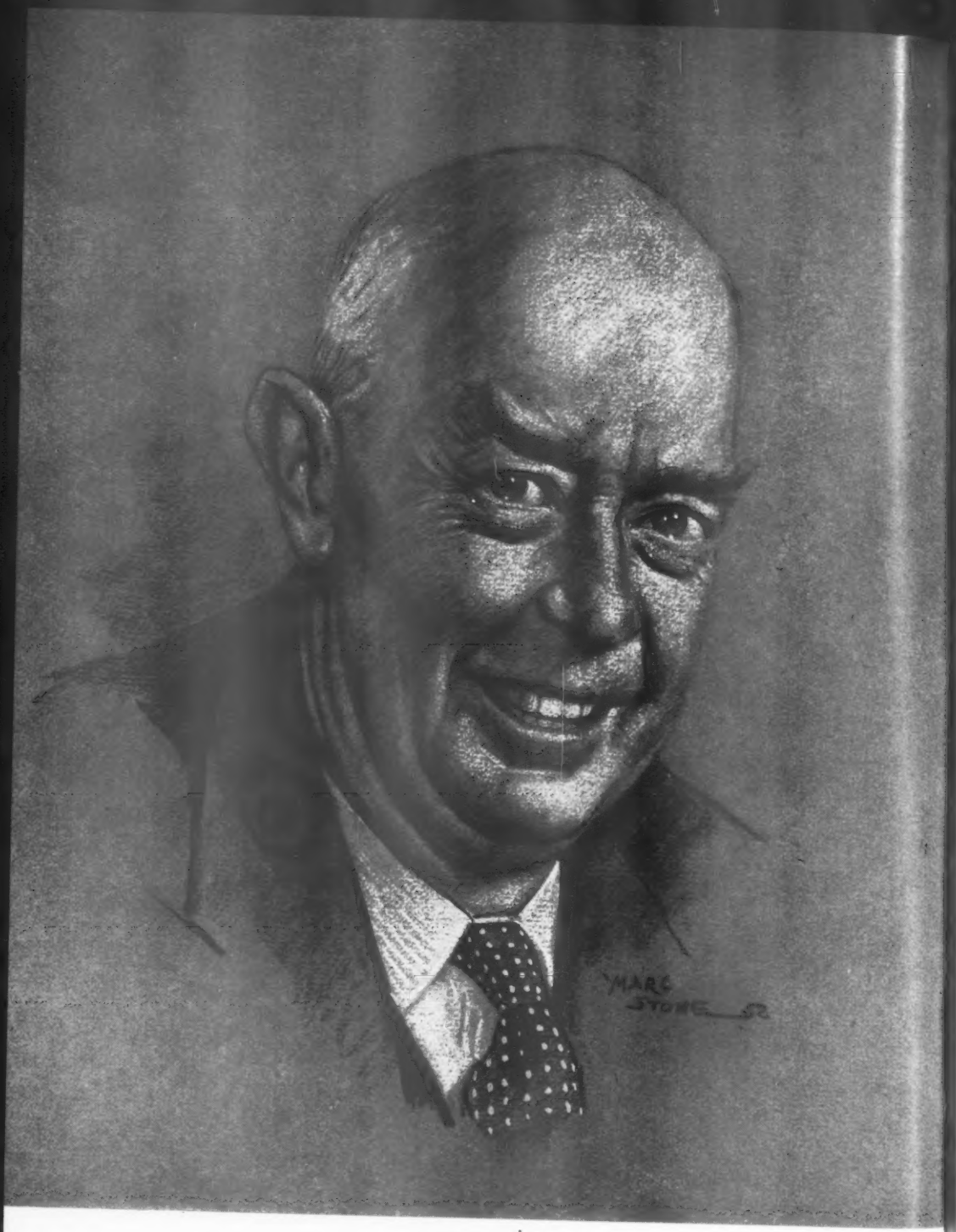
American Die-casting Practice

Completing the series of Anglo-American Productivity Reports on foundry practice is the one just issued on Zinc and Aluminium Die Casting.* By now, the section on management and labour can be skipped by the reader as being a reiteration of what earlier reports have already covered and it is to the technical sections that one turns for useful information. Primarily there is a wide difference between the balance of production in the two countries. Here, it is the gravity die-casting, or as the Americans call it permanent mould practice which predominates, whilst it is the pressure die-casting process which takes pride of place in the United States, where the consumption of these products per head of population is so very much higher. The Report fails to give the proportion of sand castings to die-castings in America, but here it is the latter which preponderate.

The team, which was jointly sponsored by the Zinc Alloy Die Casters and the Light Metal Founders' Association, have produced an excellent Report, for die-casting is essentially an industry which is based on "know-how." Undoubtedly, it is in the field of pressure die-castings that the Americans excel, especially in the production of quite large castings. It was pleasing to read that much attention is being paid to shop temperature, as a large die-casting shop, with its evenly-disposed array of open-topped vessels of liquid alloy, to our mind, does make conditions slightly worse than an open-hearth shop, as in the latter case one can remove one's self from the source of heat. There seemed to be no statement in the Report as to improvement in the rather puerile methods used here in the mornings for warming up the dies with gas jets. This must surely rank as one of the most inefficient processes used in foundry practice. This is somewhat surprising, for die-casting has been evolved and developed by the inventive mechanic who has given much time and study to small details. The recording of results is covered in great detail in the Report and if, by following the information given, a reduction is made in waster production every time a die is reintroduced into service, then real economies will be achieved.

Routing is comparatively easy in die-casting practice, yet mechanical handling is not widely used. Certainly, the heaps of newly-made castings remaining at the side of the operator do not make for good working conditions. This feature is rightly stressed in the Report. Like the sand-cast foundry industry, the American die-caster places much reliance on "outside" patternmakers—or, in this case, the die-sinker. It is of some interest to note that in this country, too, the practice is increasing. Because the Report is well balanced, well written and well illustrated, we strongly recommend its serious perusal by all our readers interested in aluminium and zinc-alloy castings.

* Published by the Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1; price 4s. post free.



VINCENT JOBSON

Chairman and Managing Director of Qualcast Limited

Leaders of the Industry

J. E. V. JOBSON

VINCENT JOBSON, chairman and managing director of Qualcast Limited, chairman of Aga Heat Limited and a director of Allied Ironfounders, Limit ed, represents a fourth generation of a family of ironfounders. The first three never got very far, but V-J, as he is popularly known throughout the industry, has achieved phenomenal success in this very field and to-day he is connected with no fewer than 28 foundries. He started life by running away from home and carrying parcels at Liverpool Street station. Returning home, he was given a 5s.-a-week job in the fitting-shop at his father's stove-grate foundry. During the 1914 war, he was about the first manufacturer to be heard of who carried out tests on " rest pauses " in collaboration with the Factory Department. This no doubt inculcated an interest in time-study and productivity long before the words had reached their present significance. To convert his dreams into solid business, pioneering was an essential and to this must be placed to his credit the technical and commercial success in this country of the Eaton continuous die-casting process for the extremely rapid production of near-precision iron castings. Whilst V-J makes no pretensions to being a scientist, his interest in technology is shown by the fact that in seniority he is within the first ten members of the Institute of British Foundrymen, having joined in 1909.

On a number of occasions the great leaders of this industry have been asked to what they attributed their success and a usual reply has been " my ability to surround myself by people who matter." An answer for V-J would be to say " by inspiring confidence in everyone whom he controls or with whom he does business." This he brings about by stating a situation, not only in terms which will be readily understood and appreciated, but from somewhat unusual angles, which treatment ensures a lasting impression. For the last few years, in his public speeches V-J has propounded with devastating logic and practical examples the need for equitable treatment by the Chancellor of the Exchequer for those highly skilled in management, and for receipt by managers of commensurate remuneration *after* taxation has been met. He puts this case very much more incisively than any other prominent industrialist. Among his pithy remarks of recent years the latest is:—

> " To-day, we have a position in which the Government, through taxation, is a majority sleeping partner in industry, one who runs no risk of losing his capital—because he has none—but who relies on his junior partner to provide all the plant and working capital necessary, all the organization and take all the risks of the trade."

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

IRON AND STEEL BILL

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I have read with interest the correspondence which has recently been published in the FOUNDRY TRADE JOURNAL on the subject of the Iron and Steel Bill.

I noticed that Mr. Lee stated in his letter of November 13, 1952, that on December 13, 1951, the Chairman made a full statement to the C.F.A. Council of the negotiations to date with the Ministry of Supply and the Joint Iron Council, which was unanimously adopted. (This statement no doubt was in connection with the inclusion of ironfoundries in the Iron and Steel Bill.)

Were the C.F.A. acting unconstitutionally, first, in speaking on behalf of a large section of the foundry industry who are not members of the C.F.A., and are, therefore, not represented by this Association? Secondly, their action in agreeing to the inclusion of the ironfoundries in the Iron and Steel Bill is in distinct contradiction to the statements outlined in their booklet entitled "To Make Your Voice Heard," which was issued to non-member foundries a short time prior to December 13, 1951.

There is no doubt that this booklet was issued for the purpose of persuading ironfounders to join the C.F.A., thus avoiding the consequences of Government control in the industry, and I now propose to give extracts from this booklet in which the C.F.A. state are some of their aims and objects. "To oppose measures that will be harmful to the industry." Any form of state control kills initiative and enterprise and is therefore harmful to the industry. "To keep independence of action for individual ironfounders." No such thing as independence exists under state control, permission can only be obtained, as a rule, by the filling in of forms.

Then under various sub-titles are printed the following extracts:—

"*Why do we need such a body?* Government intervention in the affairs of industry, the national distribution of raw materials, the rearmament programme—these alone would justify the existence of the C.F.A. "The mere size of the ironfoundry industry and its importance to national prosperity require that it should be able to speak with one voice at national level. Clearly there must be a powerful body representative of the industry, capable of negotiating with Government departments and other authorities."

(Does the inclusion of ironfounders in the present Iron and Steel Bill mean that the C.F.A. have not been powerful enough to prevent Government interference in the ironfoundry industry? On what authority did the C.F.A. claim to speak on behalf of that section of the ironfounding industry who are not members of this Association, in giving their support to the Iron and Steel Bill?)

"*Why do we need such a body?* It is vital, too, that the industry should be able to present a common front and work out for *itself* a progressive policy of development, modernization and productivity. Only in this way can *liberty* of action be retained, and *further Government intervention be shown to be unnecessary.*"*

(What liberty of action can be retained when the Control Board of Governors, which is to be set up under this Bill, will have the right to fix prices and also to restrain anyone from providing means for additional production facilities without the consent of the Board?)

"*Raw Materials.* Only through the C.F.A. can the needs of the industry be represented as a whole, and where differences exist it is better that these should be resolved *within the industry* than submitted independently to the arbitration of Government officials."

(It would appear from the reading of the Bill, that if it is passed in its present form the C.F.A. will serve no further useful purpose in the matter of distribution of raw materials or progress of the industry for that matter, as all of this will be in the hands of the Board of Governors.)

"*Retaining the Initiative.* The success of the Development Panel has justified the stand made by the C.F.A. in defence of *its principles of individual freedom combined with voluntary improvement and co-operation.* The C.F.A. does not mean to become a sort of *extension of a Government Department.*"

(Surely the C.F.A. must become an extension of a Government department when this Bill is passed in its present form, and what freedom of action will individual foundries have in the future?)

"*For the Common Good.* Besides working for a fair deal for the industry and trying to get necessary development done on the *industry's own initiative*, the C.F.A. does a number of jobs which can only be done centrally or by joint action."

(If the Iron and Steel Bill is passed in its present form, the ironfounding industry in the future will be allowed to possess no initiative, as everything will be planned for them in the way of development, production, raw materials, and prices.)

"*Working Conditions.* Despite the hardships imposed on ironfounders by building controls, shortages of materials and restrictions on capital expenditure, the industry has spent several millions of pounds on modernization, in recent years. Working conditions in the industry have been steadily improved, and C.F.A. policy is to encourage and help ironfoundry employers to implement still farther the recommendations of the Garrett Report. But, *the C.F.A. resolutely maintains that this work must be allowed to proceed by voluntary action of employers and not by the introduction of rigid Government regulations.*"

(According to the Bill it would appear that the Board of Governors will be responsible for making arrangements for the health, welfare and safety of persons employed in the foundry industry. Does the Factory Act no longer function in this country? What about voluntary action and rigid Government regulations they so glibly refer to?)

"*Increasing Efficiency.* On the initiative of the Development Panel, an Operational Research Advisory Team was formed by the B.C.I.R.A. with the object of helping every ironfounder to get the best possible results in his own foundry. Constituent associations have been helped to work out co-operative ways of comparing efficiency within their own sections of the industry."

(Can the C.F.A. mention any industry which has increased its efficiency since coming under the jurisdiction of Government control? They themselves state on Page 4 of their booklet, that they are "continually pressing the National Transport Services to improve their efficiency by applying all possible means of economy.")

It would be very interesting to non-member firms to learn from the C.F.A. how they can explain their action in agreeing to the inclusion of the ironcasting industry in the de-nationalization of the Iron and Steel Industry's Bill, particularly when the ironfounding industry was not nationalized in the first place.

Secondly, why they have committed the foundry industry to the tender mercies of a Government Control

(*Continued on page* 646)

* The italics are those of our correspondent—EDITOR.

External Dust Control for a Pedestal Grinder*

Part I by W. H. White, F.R.S.A.
Part II by W. B. Lawrie, M.Sc., F.R.M.S., A.I.M.

Since a previous publication drew attention to the aerodynamics of certain conventional local exhaust systems fitted to pedestal grinders, an attempt has been made to elucidate further fundamental information, to devise a more-efficient exhaust system and to reduce the volume of air required. The present Paper describes the experimental work which finally led to the construction of a prototype, and concludes with early dust estimations made on it. The velocity and direction of the air movements caused by the rotation of a grinding wheel in still air have been determined, and a cinematograph film has been made which records these movements photographically. The movement of dust clouds, both with and without local exhaust ventilation, has also been recorded, and still photographs from the film are included.

PART I—EXTERNAL EXTRACTION SYSTEM

A British Steel Founders' Association paper [1], published in the 1951 Conference of the Institute of British Foundrymen described new methods of dust control and a new technique for the observation and cinematography of moving dust clouds in works conditions. Amongst other matters this paper showed the inadequacy of conventional local exhaust ventilation methods when applied to certain pedestal grinders. The grinders were fitted with wheels running at a peripheral velocity of 9,000 feet per minute and the application of Lawrie's dust observation technique resulted in a film showing that on these machines an appreciable amount of dust followed the wheel round and was discharged at high velocity from the space between the top of the wheel and the cowl. This stream of dust-laden air was then seen to strike the operator's chest and diffuse upwards past his face. It was apparent that the intake velocity of the local-exhaust ventilation system was insufficient to overcome the fan effect on the wheel, and the Authors concluded that "the fan effect of rotating wheels must be used to assist in control of the dust, or means must be devised to strip the moving dust cloud from the periphery of the wheel." A further general conclusion drew attention to the necessity for considerable changes in the design of local exhaust ventilation systems to attain efficient dust control, and the still more urgent need for careful aerodynamic studies in order to obtain more satisfactory equipment.

The floor stand grinder is used in all foundries, and is normally fitted with somewhat expensive dust extraction equipment which incidentally extracts large quantities of heat. This heat must be replaced during winter, so that the cost of the dust extraction system is increased by the corresponding necessity to provide a heating plant large enough to compensate for the extraction losses. The problem raised, therefore, was of great importance to the industry and received the immediate attention of the Foundry Atmospheres Committee of the British Cast Iron Research Association. As a result a new method of local exhaust ventilation has been fitted to a 14 in. pedestal grinder and early tests have indicated a measure of success which appears to justify the publication of the work, if only to inform other investigators of the means that have been adopted and the progress that has been made.

Preliminary Considerations

Ottignon and Lawrie [1] showed that the efficiency of local exhaust ventilation could be improved by the addition of an air curtain moving at high velocity and using only a small volume of air. Ottignon [1] in designing the K & L bench used an air jet to obtain this curtain, but there is no good reason why the effect should not be produced by exhaust methods, and in fact Nilsson [2] does so produce it on high-frequency melting furnaces. Quite apart from giving an increased efficiency in dust control the air curtain has the advantage of reducing the amount of air that must be extracted and so reducing the winter heating requirements of the building in which it is used. It was decided, therefore, to try to apply the system to the stand grinder.

Parsons [3] analysed the results of dust samples taken by Bloor and Lawrie [4] in twenty-four foundries, and showed that there was less difference than might have been anticipated between grinders fitted with conventional exhaust systems and machines working without locally applied ventilation. It was not known at the time whether this was due to inefficiency in the extraction system, or whether it was caused by the local exhaust appliances extracting average dusty air from all over the room in which they operated. Ottignon and Lawrie[1], however, showed later that there was good reason to believe that the traditional local exhaust system on stand grinders was inefficient, and Lawrie[1] filmed the dusty air stream generated by the fan effect of the wheel. It was seen that this air stream was of sufficient velocity to penetrate the local exhaust air stream, and it appeared that this might occur, whatever the hood design of

* Paper read before the London branch of the Institute of British Foundrymen, Mr. D. Graham Bisset presiding. Mr. White is attached to the British Cast Iron Research Association, and Mr. Lawrie to H.M. Inspectorate of Factories (Engineering and Chemical Branch).

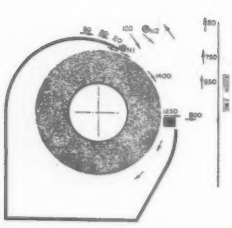


FIG. 1.—*Air Movement due to the Rotation of the Grinding Wheel; Air Velocities in ft. per min. measured by Velometer.*

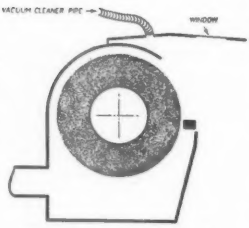


FIG. 2.—*First Experimental Cardboard External Hood fitted, together with a Vacuum-cleaner Extraction Hose, to the Grinding Wheel.*

the conventional system if the extraction volume was to be kept within practicable limits. In the written discussion of the work[1] it was recorded that Bellchambers and Lawrie observed two machines and that the one with the more efficient exhaust system still showed two main air currents. The first one, moving towards the operator, was produced by the rotation of the wheel and was carrying an appreciable dust cloud. The second stream was moving into the hood, and was produced by the extraction plant. These observations indicated quite clearly that local exhaust ventilation might extract air without controlling dust.

The following suggestions emerged, therefore, after a close examination of existing information:—

(1) That it was desirable to devise new and more efficient means of dust control at pedestal grinders;

(2) that the use of a high-velocity, low-volume air-curtain might be more efficient, and would in any case offer the advantage of a lower air volume with a corresponding reduction in air losses and heating costs;

(3) that conventional extraction methods might not be capable of reversing the high-velocity air-stream developed by the wheel which has been shown to carry the dust out of the cowl;

(4) that, if this were true, the fan effect of the wheel would have to be considered as an integral part of the extraction system; and

(5) that more fundamental information was needed with reference to the direction and velocity of the air-currents set up in the working area of an abrasive wheel rotating in space. Most of the published work dealt with high-speed wheels running at peripheral speeds of 9,000 ft. per min. and so it was obviously desirable to extend the work to wheels with lower peripheral speeds.

External Air Movements

Work was commenced on a 14 in. by 2½ in. wheel rotating at 1,400 revolutions per minute with a peripheral velocity of 5,000 ft. per min. It was at once apparent that this smaller and slower wheel was producing effects similar to those previously observed on the larger high-speed wheels. The machine was fitted with a normal type of dust-extraction equipment, but the external air movement was estimated when the ventilation system was inoperative, in order to determine the movement caused by the wheel itself. The air velocities and directions were measured by a Metropolitan Vickers Velometer and some results ars shown in Fig. 1.

It appears that the air movement can conveniently be divided into primary and sundry secondary streams. The primary stream is caused by the fan effect of the wheel, and it is this effect which ejects the dust from the top of the wheel and delivers it at relatively high velocity against the operator. It will be seen from Fig. 1 that in the case under consideration, this primary air stream moved along the face of the wheel at a velocity of not less than 1,400 ft. per min. The wheel was fitted with a normal solid work rest and this served to deflect the primary air stream through 90 deg., and decelerate it to 1,200 ft. per min.

The secondary air streams which develop will depend on the position of the operator and the shape and size of the work and considerable turbulence may result. These air streams will also be affected by adventitious draughts, but the experimental work was done in still air, and so no account will be taken of stray or erratic air movements due to causes unrelated to the rotation of the wheel. From the work rest the air moves progressively more slowly until it strikes the operator, which it did at a velocity of 800 ft. per min. in the experiment in question. Here the body of the operator once again turns the air stream through 90 deg., so that it now flows vertically upwards along his body line. There is a slight acceleration to 850 ft. per min., presumably due to other streams leaving the work rest at an angle and joining up with the main stream at this point. The speed of this moving air stream quickly decreased to about 50 ft. per min. in the vicinity of the operator's face.

In addition to this high velocity stream other air streams were also detected. One of these moved over the top surface of the cowl, reaching a speed of 50 to 80 ft. per min. before it turned over the nose of the cowl at about 20 ft. per min. Just opposite the nose of the cowl a neutral point was found at which there appeared to be no air movement (N1 in Fig. 1). Between this neutral point and the operator's body two currents were found, moving in opposite directions as shown in Fig. 1. The one nearer to the cowl was flowing downwards towards the primary stream, whilst the current nearer to the operator was flowing upwards. Between these two streams there appeared a second neutral point in the position (N2) indicated in Fig. 1.

Further observations made on a 14-in. wheel showed the primary air stream moving at 2,000 to 3,000 ft. per min. down the wheel face. Finally a short series of readings was made on a 24- by 3-in. wheel running at a peripheral speed of 9,000 ft. per min. Here the primary air stream appeared to be flowing down the wheel face at a velocity of about 4,000 ft. per min. All these readings were

taken close to the wheel face at a point half way between the cowl opening and the work rest. No dogmatic statement can be made as yet, but it appears that the primary air stream flows down the wheel face with a velocity approaching half the peripheral velocity of the wheel.

The plotting of these results at once suggested a new approach to the problem of dust control by local exhaust ventilation on the stand grinder. It was apparent that there were several air streams between the front of the cowl and the operator's face, that these streams were moving relatively slowly, and, what was perhaps still more important, that the zone included at least two neutral points at which no air movement could be recorded. It appeared therefore that the following facts had become evident:—

(1) That much of the dust followed the wheel round and was ejected at high velocity at the cowl opening.

(2) That conventional local exhaust ventilation systems seemed to be incapable of reversing this dusty air stream and so controlling the dust.

(3) That between the cowl and the face of the operator there was a zone penetrated by sundry air currents.

(4) That these currents moved at relatively low velocities.

(5) That this zone included at least two neutral points at which no air movement could be recorded.

It was also obvious that dust is generated at the point of contact of the casting and the wheel, *i.e.*, outside the conventional cowl. This means that conventional local exhust systems are operating at some distance from the point of origin of the dust.

In consequence it was decided not to persist in the hitherto unsuccessful attempt to reverse the primary air stream, but rather to let it escape, carrying the dust with it. From the velocity contours obtained it was thought that this dust could be collected much more easily and efficiently in the zone between the normal cowl and the operator's face, where advantage could be taken of the lower velocities and the neutral points. A further advantage that might be obtained was that a wider gap might be tolerated between the wheel face and the cowl. On the normal stand grinder the size of the opening left between the wheel and the cowl is critical, and an adjustable nose piece is commonly fitted to the cowl so that this gap can be reduced to a minimum. It was known that careless adjustment of this gap reduced the efficiency of normal equipment, but it was thought that no such critical adjustment would be necessary if the dust was allowed to leave the hood at this point, in order that it might be collected later.

In order to test the validity of this suggestion an adjustable nose piece was fitted to the end of the cowl on the prototype machine. This nose piece allowed the gap to be varied from $\frac{1}{16}$ to 1 in. Air velocity readings were taken in the primary stream on the face of the wheel $\frac{1}{2}$ in. from the nose piece and also halfway between the nose piece and the work rest. A third reading was taken on the edge of the work rest remote from the wheel. Readings obtained when the external extraction system was inoperative are given in Table I.

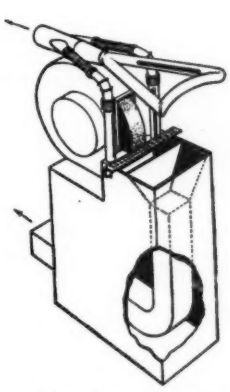


FIG. 3. — *Prototype System for the 14-in. Wheel fitted with Long Extraction Arms.*

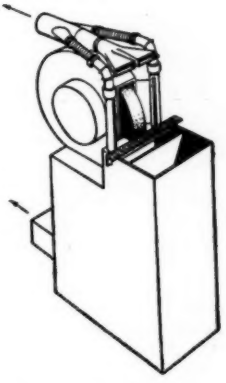


FIG. 4.—*Prototype Extraction System Modified to accommodate larger Work and fitted with Nozzles.*

TABLE I.—*Air Velocities Generated by a 14-in. Wheel Rotating at 5,000 ft. per min.*

Gap between cowl and wheel (inches.)	Air velocity on wheel face ½ in. below cowl (ft. per min.)	Air velocity on wheel face midway between cowl and work-rest (ft. per min.)	Air velocity at outside edge of work-rest (ft. per min.)
1/16	2,000	2,000	1,600
1/8	2,600	2,400	1,600
1/4	3,000	2,800	1,900
3/8	3,000	2,800	1,900
1/2	3,000	3,000	1,900
3/4	2,700	2,700	1,800
7/8	2,700	2,600	1,600
1	2,500	2,600	1,600

The velocities in the primary stream on the wheel face rose from 2,000 ft. per min. when the gap was $\frac{1}{16}$ in wide to about 3,000 ft. per min. when the gap was $\frac{1}{2}$ in. wide, and then decreased to about 2,500 ft. per min. when the gap was 1 in. wide. The observations were then repeated with the local exhaust ventilation system working and it was noticeable that there was no difference in the results.

These readings represent early experimental work only. They do, however, substantiate the suggestion that the gap between the cowl and the wheel face will not be critical if the dust control is obtained by means of the external system described in this work.

External Hoods

It was decided at this stage to test the validity of the observations and deductions which had been made, and for this purpose an external hood was fitted to the pedestal grinder on which the work

had been done. No serious attempt was made to design this hood which was constructed of cardboard and attached to the machine with adhesive tape. The general appearance of this first experimental hood is shown in Fig. 2. The wheel was provided with a conventional exhaust system, and the cardboard hood was fitted with the exhaust pipe of a vacuum cleaner which would extract 80 cub. ft. per min. A Perspex window was inserted into the top of the hood so that the operator could see the work. The hood was long enough to extend from the top of the wheel cowl to the operator's chest, so forming a physical barrier, interposed between the level at which the dust cloud was known to exist, and the breathing level of the operator. This arrangement takes advantage of the neutral points from which it was hoped to collect the dust by means of the small quantity of air drawn through the hood by the vacuum cleaner.

The wheel was used with the vacuum cleaner exhaust only, with the normal exhaust only, and with both together, and the movement of the dust cloud is described and illustrated in Part II of this Paper. Two particular points emerged. One was that the primary air stream split into three streams after striking the top of the casting. The main stream moved out towards the operator as shown in Fig. 1, but two minor streams flowed along the casting top, parallel to the axis of the wheel. The second point was that the orientation of the work with respect to the wheel face affected the dust distribution so that in certain cases some of the dusty air flowed downwards towards the operator's feet. It was evident, therefore, that provision would have to be made to collect these dust streams.

The Authors did not anticipate that the very crude arrangement described would control the dust generated by the grinding operation, nor, in fact, did it do so. On the other hand, the experiment was considered sufficiently successful to proceed with a design which would incorporate the following features:—

(1) A high velocity, low volume air-curtain was to be used.

(2) The extraction system was to be external to the wheel cowl and collecting box.

(3) Provision was to be made to collect the dust which flowed along the rest, parallel to the wheel axis.

(4) Provision was to be made to collect the heavier dust together with any dust which might leave the work rest or the casting in a downward direction and move towards the feet of the operator.

External Extraction System[5]

The 14-in. wheel which had been used throughout was fitted with an external extraction system as shown in Fig. 3. The system was designed to provide dust extraction by high-velocity air curtains at a number of points adjacent to the working part of the wheel. This was done in order to collect as much dust as possible at its point of origin, and also to collect the dust from the primary and secondary air streams generated by the fan action of the wheel.

The design consisted of a closely-fitting cowl which enclosed about half of the wheel, and which was mounted on a bottom collecting box. Neither the cowl nor the box had any direct exhaust connections, so that the part of the primary air stream which flowed either past the casting being ground, or through the perforated work rest, carried the heavier dust into the box. This obviated the necessity for transporting heavy dust along the exhaust ducts, because the box was large enough to reduce the air velocity and allow the dust to settle; any dusty air which plumed out of the top of the box was collected by the local exhaust system. It should be noted that the work rest was perforated to allow the primary air stream to flow into the box.

The external exhaust ventilation system represents an application of high-velocity air curtains which use small quantites of air. At the front of the box, level with the work rest, a small hopper was fitted and connected to a ventilation duct. In the prototype the air velocity in this duct was 2,200 ft. per min., giving a velocity of 1,000 ft. per min. round the hopper rim, with a velocity of 800 ft. per min. at the centre point of the plane of the hopper opening (see Fig. 3). In later models this hopper was discarded in favour of a slot opening surrounding the work rest. A high-velocity air curtain is induced in the slot, so that dust is collected by a smaller air volume than was needed for the hopper.

The main extraction duct is brought over the top of the cowl and divided into four branch pipes. The middle pair of branch pipes are extended at the level of the top of the cowl to a point some 8 in. beyond the wheel circumference at the same time being expanded into a "V" shape. The ends of these branch pipes are plugged and joined with a concave breast plate against which the operator can lean when working. Two slots along the inside of these branch pipes provide an air curtain, between the arms of the "V." The air velocities at the slot openings vary from 4,000 to 5,000 ft. per min., with a velocity of 200 to 250 ft. per min. along the centre line of the "V." The object was to set up, between the point of dust generation and the breathing level of the operator, an air curtain which could not be penetrated by dust-laden air streams rising from the grinding action.

The outside pair of branch pipes which are taken from the main duct are turned vertically downwards by means of flexible connections, and are supported in socket rings on hinged wing plates, one from each side of the wheel guard. The air velocity at the slots in these vertical pipes is 3,500 ft. per min. and serves to collect dust which flows along the rest of the work in a line parallel to the wheel face (see Fig. 3). In this design, which is fitted with stirrup arms extending over the work in a "V," the operator can see the work through these arms, and in leaning against the breast plate, virtually seals off any dust streams which might be rising outside the zone of influence of the system.

Large work might be difficult to handle under the stirrup extraction arms, so the system was modified as shown in Fig. 4. In this case the centre pair of branch pipes from the main extraction duct were terminated in the form of two short nozzles just above the cowl openings. The air velocity at the nozzle and openings was 5,000 ft. per min. These nozzles offer no obstruction of any kind to the operator and the high-velocity extraction air stream would still be taking advantage of the low velocity of the dust bearing streams and the neutral points previously discussed.

The nozzles appeared to be just as efficient as the stirrup arms in forming an air curtain between the point of generation of dust and the breathing zone of the operator, and had the further advantage that the operator could see the total working area, was not restricted as to height of casting and had freedom of manipulation for grinding. There is, of course, slightly less resistance in this air duct by reason of the nozzles being connected in direct alignment with the main duct. A further advantage of the application of the nozzles is that the total area of their aperture is less than half that of the stirrup arms and therefore the proportion of displaced air is in similar ratio.

Equipment

It will be noted that two fans of different performances were used for this experimental front ventilation system. This was purely for convenience as they were available on site. Normally only one high-pressure type fan would be connected to the ventilation system of a stand grinder.

The fan connected to the top and side extraction ducts was a high-pressure type motor-driven, centrifugal fan with a 4½ in. diameter inlet and a 2½ in. diameter outlet, rated at 150 cub. ft. per min. against 19 in. static water gauge and absorbed 1.0 brake horse power running at 2,900 r.p.m. For the purpose of this experiment the fan inlet was reduced by a long taper piece to 2½ in. diameter with 22 ft. of 2½ in. diameter pipe in the delivery side, with a free outlet. The fan displaced a total of 255 cub. ft. per min. at 10 in. static water gauge and absorbed 1.36 brake horse power running on full load.

The fan connected to the bottom extraction duct was a centrifugal type, enclosed within a self-contained dust settling unit, rated at 800 cub. ft. per min. against 4 in. static water gauge, absorbing 2 brake horse power running at 2,850 r.p.m. For the purpose of this experiment a 3½- by 4-in. duct was tapped off the 8-in. diameter inlet duct to the fan. The fan displaced a total of 213 cub. ft. per min. at ¼ in. static water gauge and absorbed 0.75 brake horse power running at full load.

Conclusions

(1) The fan-effect of a rotating wheel results in a high-velocity primary air stream which flows from the cowl opening down the wheel face and impinges on the work rest. With a wheel having a peripheral velocity of 5,000 ft. per min. this primary stream has a velocity between 2,000 and 3,000 ft. per min., and if the wheel peripheral velocity is 9,000 ft. per min. the velocity of the primary stream may rise to 4,000 ft. per min.

(2) Between the cowl and the face of the operator there is a zone which is penetrated by sundry secondary air currents.

(3) These secondary air currents move at relatively low velocities.

(4) Two neutral points were found in this zone at which no air movement could be recorded.

(5) Conventional local exhaust ventilation as fitted to a 14-in. wheel was ineffective because the exhaust air failed to reverse the primary air stream.

(6) A close-fitting cowl and a large collecting box have been fitted, but no direct local exhaust-ventilation has been applied to either cowl or box. The object of the box is to collect the heavier particles resulting from the grinding action.

(7) An exhaust system, external to the cowl, provides high-velocity air-curtains to control the dust-laden air stream which would otherwise be dispersed into the general atmosphere.

(8) A reduced dust burden is handled by the exhaust and settling systems because the heavier dust is not conveyed along the system but remains in the box.

(9) Ducts of small diameter are used in the exhaust system.

(10) A smaller air volume gives less heat losses from the shop in which the machine operates.

(11) The system offers the advantage of low running-costs.

REFERENCES

[1] R. F. Ottignon, and W. B. Lawrie, "Observation and Control of Dust in Foundry Dressing Operations," *Proc. Inst. Brit. Foundrymen*, 1951, Vol. XLIV.

[2] K. Nilsson, "Ventilation Methods in Swedish Foundries," British Cast Iron Research Association, Conference on Heating, Lighting and Ventilation for Iron Foundries, Sept., 1951.

[3] J. W. Parsons, "Steel Foundries Dust Survey. Second Report of the Dust in Steel Foundries Committee," H.M. Stationery Office, London. Appendix 6.

[4] W. A. Bloor and W. B. Lawrie, "Summary of Dust Estimations in 33 Foundries. Second Report of the Dust in Steel Foundries Committee," H.M. Stationery Office, London. Appendix 5.

[5] British Provisional Patent No. 6961/52.

(*To be continued*)

Automatic Sliding Doors

Doors developed primarily for lift entrances by the Express Lift Company, Limited, Magnet House, Kingsway, London, W.C.2, have been adapted to provide automatic sliding doors suitable for factories and warehouses. Because the doors close automatically they prevent draughts and facilitate the maintenance of a constant temperature within the shop, thus ensuring maximum benefit from the consumption of fuel for space heating. The doors consist of two sliding panels opening from the centre and running on ball-bearing rollers carried on bright-steel tracks. They are opened and closed by an electric device which, to prevent excess torque, incorporates a clutch. Fitted to the doors is a sensitive edge that ensures their instant reversal should an obstruction be encountered, and an adjustable time delay is embodied in the controller so that the doors are held open for any pre-determined period within the limits allowed. The doors are opened by means of press buttons which can be fitted at any convenient point.

Correspondence—continued from page 640

Board, particularly in view of the results of such control over other industries during the past six years.

Thirdly, how can they explain their recent action, which is in direct contradiction to those expressed in their booklet "To Make Your Voice Heard," extracts of which have been given earlier.

Finally, I have read in the national Press that the Minister of Supply, Mr. Duncan Sandys, has given his reasons why the ironfounding industry is to be included in the Bill. His main reasons are that the ironfounders are large consumers of the same raw materials as the steel producers, and in his experience a single body should exist to handle the common problems of the Iron and Steel Industry as a whole. What problems have the ironfounders in this country that cannot be solved within the industry apart from unfair distribution of the various grades of pig-iron ?

He also states that he recognizes that foundries, particularly those operated by engineering concerns, were in a special position and that the Board's supervision over them should be of a much broader character than over the steel industry. Special provisions had, therefore, been incorporated in the Bill to ensure that small foundries were not subject to detailed supervision.

The way I read this implies that someone has informed the Minister that those foundries operated by engineering concerns are only small foundries, which as everyone knows is far from the truth, as some of the largest and most efficient foundries in this country are a department within an engineering works, and any interference whatsoever in the control or direction of such foundries may have serious repercussions in our fight against foreign competition in the world's export markets.—Yours, etc.,

G. W. NICHOLLS.
Modern Foundries Limited,
Highroad Well, Halifax.

November 25, 1952.

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—Mr. R. C. Shepherd's letter in your JOURNAL of November 13 calls for comment.

In quoting Clause 5(1), page 5, of the Iron and Steel Bill, published by H.M. Stationery Office, Mr. Shepherd does not continue to the contents of the following page, which read:—

"The Board shall not refuse their consent to any proposal submitted to them . . . unless it appears, after consultation with the person making the proposal . . . that the proposal will seriously prejudice the efficiency and economic development of production facilities in Great Britain. If the Board refuse their consent to any such proposal, the person may appeal to the Minister from that refusal."

Looking at the relevant clauses, it will be seen that the Board will be empowered to require that all *major* schemes of development shall be submitted to it to ensure a balanced development of the industry. However, as it is recognized that it is a serious matter to interfere with the right of companies to spend their own money in their own way, there is a right of appeal to the Minister against the decision of the Board.

In my letter which you published on November 6, I stated that it is not proposed to give the Iron and Steel Board any *important* powers not already vested in the Ministry of Supply. The further points brought forward by Mr. Shepherd may or may not be considered important, but may I reply to them as follow:—

(1) "That the expenses of the Board are to be met by a levy from the industry."—It will probably be agreed by most founders that it will be a better proposition to pay members of a Board who have a wide experience of production, labour, administration or science associated with iron and steel, than certain Ministry officials, who have never previously had experience of the industry.

(2) Mr. Shepherd takes exception to the clause that it is obligatory to furnish records as may reasonably be required by the Board. In this, Mr. Shepherd, in all cases, is assuming that the Board is going to act unreasonably. Surely, if this were the case, it makes it more necessary than ever that the ironfounding industry should have a representative on the Board to safeguard its interests. This has been the objective of the Joint Iron Council.

(3) Mr. Shepherd reminds us of penalties. "If any person fails to comply . . . he shall be liable on summary conviction to imprisonment . . ." In point of fact, the new Board will be much more charitable than the M.o.S. The prices Orders now issued by the Government are backed by criminal law. The new Board will only enforce its orders through civil proceedings. However, I doubt if it will be much comfort to a founder if he finds himself in gaol, whether he was put there by criminal law or civil injunction.

Mr. Shepherd, Mr. Whitham and Mr. Kain appear to forget that the Bill has been brought forward by a Conservative Government that has knowledge of the industry, and whose members are as keen on free enterprise as they are. Its clauses will be interpreted accordingly. They need not be afraid of the Bill if a left wing government ever comes to power. The socialists are prepared to tie up their own parcels, and steal the silver platter as well.—Yours, etc.,

JAMES BELL.
Somerset House, Temple Street, Birmingham, 2.
November 24, 1952.

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*[Owing to shortage of space, other correspondence has been held over until next week—*EDITOR.*]*

I.V.E. Section Notes

The Midland section of the Institute of Vitreous Enamellers held a successful theatre and dinner party last week at the Station Hotel, Dudley, followed by a visit to the Hippodrome. About 80 members attended. The section is also organizing a men-only dinner to be held at the Imperial Hotel, Birmingham, on January 31, 1953. Applications for tickets (price 17s. 6d.) should be made to the secretary Mr. D. Sleath, c/o Borax Consolidated Limited, 87, Edmund Street, Birmingham 3.

New I.B.F. Sub-committees

A new sub-committee (T.S.46—Mould Materials) has been formed by the Institute of British Foundrymen under the chairmanship of Mr. J. Hird, with the following terms of reference: "To investigate the effect of mould materials on the cooling rate in the solidification range of cast metals, with particular reference to cast iron." This sub-committee has been formed as a result of the work of sub-committee T.S.33 and its predecessor T.S.21. Yet another new sub-committee, T.S.45—Non-ferrous Quality Test, is also announced, which will investigate the possibility of developing a suitable fracture test or other quick routine test for assessing melt quality of copper-base and aluminium-base alloys. Mr. Logan is chairman of this sub-committee.

Shell-moulding Developments

The shell-moulding process presents an interesting example of the inevitable delay between the introduction of a new idea and its full use in industry. The first application in this country for Patents on this process was made as far back as the start of 1947* *but it is only within this last twelve months that really widespread interest has developed. Some of this delay has been caused by "teething" difficulties, but the biggest obstacle to the widespread use of the process has undoubtedly been in the lack of information about shell moulding.*

Some idea of the increasing interest in the shell-moulding process may be obtained from Fig. 1, which shows typical castings produced by the method. Fortunately for the British foundry industry the many patent applications dealing with specific improvements to the process have been filed not by a company concerned mainly with the actual production of castings (and thus interested only retaining them exclusively for their own use), but by a firm whose objective is to foster the use of the shell-moulding process wherever it is desirable. To this end, licences are freely available, covering the use of the firm's Patents, as well as a tremendous amount of "know-how" developed in over six years' continuous research.

Process Requirements

The shell-moulding process is basically an extremely simple conception, but it is the use of correct detail at each stage that enables particularly high-grade castings to be produced. The starting point is a suitable metal pattern or metal corebox. The use of metal construction is essential, since the mixture of sand and resin is actually cured on the pattern or corebox which must, therefore, be able to withstand temperatures in excess of 300 deg. C. The development of the shell-moulding process to the state shown in Figs. 1 to 4 has, however, meant that virtually all existing metal patterns and coreboxes can be used, with very little modification, with the exception of those including white-metal, which alloy melts at too low a temperature. The achievement of this step forward was by no means simple, since normal foundry equipment is designed to handle sand moulds and cores which are soft enough to be readily stripped. In shell-moulding, however, the mould or core must be cured so that the thin wall will withstand the pressure of metal during pouring. This means that softness must be sacrificed to obtain the necessary strength in the thin shell.

Stripping

To achieve easy stripping of the cured shell moulds or cores, two main lines of approach are possible. The first of these is to coat the surface of the metal pattern or corebox with a stripping solution and the second is to use some positive form of ejection medium. The early information recommended paraffin as a suitable stripping agent since it "remains liquid and provides a uniform oily film," and one report goes on to state "that the half-mould is easily stripped from the pattern-plate by means of lifting pins, as the thin film of paraffin acts as a lubricant." Had the position been as simple as this, the shell-moulding process would have been widely used far sooner. Unfortunately, it has taken several years and much expensive research before stripping has become a foolproof and entirely predictable operation. Reliability is now ensured by a suitable stripping solution assisted by one of the mechanical ejection systems available.

Operational Details

Before starting to make moulds, the pattern-plate is heated to about 160 deg. C. and is brushed or sprayed with the stripping solution (Fig 2(a)). The plate is placed with the pattern downwards over the top of a "dump box" or bin mounted on trunnions (Fig. 2(b)). This bin is filled with a mixture comprising mainly sand and a thermosetting phenolic resin. On inverting the bin (Fig. 2(c)), the mixture is deposited evenly over the face of the pattern-plate. The heat from this plate causes the resin

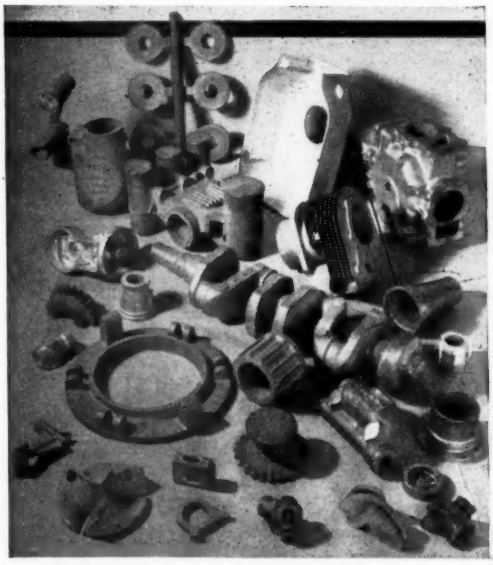

FIG. 1.—*Typical Group of Castings produced by the Shell-moulding Process in Various Types of Metal.*

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* By Polygram Casting Company, Limited. The patent situation in this country was the subject of a statement from this company printed in the JOURNAL, November 20, 1952.

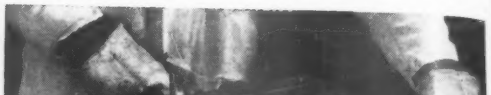


FIG. 2.—*Six Stages in the Production of a Shell Mould: (a) Brushing the Heated Pattern-plate with a Stripping Solution (Spraying may also be used); (b) Heated Pattern-plate clamped, face downward, over the Mouth of the "Dump Box." Note the solid cast structure of the pattern-plate and the spring loaded ejection plate between its legs; (c) Inversion of the Dump Box deposits the Sand/Resin Mixture over the Surface of the Heated Pattern-plate; (d) Pattern-plate on removal from the Dump Box is complete with a Half Shell Mould. Mould and Pattern-plate are next placed in the Curing Oven; (e) Cured Mould being removed from the Pattern-plate by pressure on the Ejection Plate below. Conical Projections at the corners of the Pattern-plate give accurate Locating Depressions in the Mould, and (f) Finished Half Mould or "Biscuit."*

to melt and form a thin shell (about ¼-in. thick) over the entire surface of the plate. Due to the fine structure of the sand used, the surface of this shell follows the contours of the pattern extremely closely. After a few seconds, the dump bin is returned to its original position and the excess mixture drops off the pattern-plate, leaving the shell still adhering to the plate. The plate and shell are then removed from the bin (Fig. 2(d)) and placed in a curing oven. If the actual oven temperature is held between 350 and 450 deg. C., the curing time for the half-mould will lie between about 1½ and 2 min. Such curing is rendered very even by the combined action of the heat from the oven and from the pattern acting on opposite sides of the shell. The time quoted is sufficient for the operator to complete the work on another half-mould so that no time is wasted in curing. In order to work such a cycle, it is not necessary to have duplicate pattern-plates for one job since it is quite possible to work two different plates, or better still, form the two halves of the same mould alternately. A complete mould is, therefore, produced every two cycles or, say, every three minutes.

Coremaking.

A very similar process is employed for making shell cores. A sand/resin mixture may be either blown or placed by hand in the heated metal corebox. A thin shell is built up having the same shape as the corebox and the stripping of this shell is again ensured by the use of a stripping solution and sometimes also by positive ejection. Shell cores are located in the normal way by core prints and it is possible to obtain extremely exact location of the core since the position of the two half-moulds is very accurately regulated by arranging a projection on one half-mould and a corresponding depression in the other half. These methods of location are an integral part of the pattern construction.

Clamping and Casting.

After removing the pattern and half-mould from the oven, the mould must be stripped. In Fig. 2(*e*) this is carried out by a number of suitably-spaced pins mounted on a plate. This plate is spring loaded so that normally pins are in the retracted position and ejection is effected by pressing the pattern-plate downwards to bring the pins forward simultaneously. The half mould, or "biscuit" as it is sometimes very descriptively called, is then complete. It can be assembled at once for pouring or it can be stored for an almost indefinite period until required. As these biscuits weigh only a matter of pounds, they can be made in one place and transported to another in a way quite impossible with normal moulding boxes. Biscuits can be stored in piles taking up very little space and even when assembled and ready for pouring, a shell mould takes up only a fraction of the space needed for moulding boxes. A return to this point will be made again when discussing relative costs.

The two half moulds are held together by any convenient method, such as clips, soft-iron nails, etc. The mould can be poured in either the horizontal or vertical plane, the method of holding the mould being adapted to suit the circumstances. Where technical considerations do not require a vertical mould, the horizontal position is generally preferable since the reduced head of metal needed to run the metal into a horizontal mould means lower pressures on the bottom walls of the mould.

Knock-out

Immediately the mould has been poured, the heated metal ignites the resin binder, which is rapidly burnt out. If the mould is then picked up by the sprue and dropped on to the ground from a height of about 2 ft., the mould material will fall away from the casting. Indeed, in many cases, the casting can be picked straight up from the remains of the mould and freed from sand by a light tap. The casting is completely freed from adherent sand without further work. Dimensional limits can be held to ±0.002 to 0.003 in. over each half of the casting and tolerances of perhaps ±0.005 to 0.010 in. can be held on dimensions crossing the parting line.

Applications

The shell-moulding process is applicable to virtually all ferrous and non-ferrous metals, though special parting compounds have to be used when casting magnesium, which reacts chemically with the resin binder. The finish on all metals is better than that obtained on similar sand castings. On materials which are least amenable to this process, such as low-carbon steels, the finish shows appre-

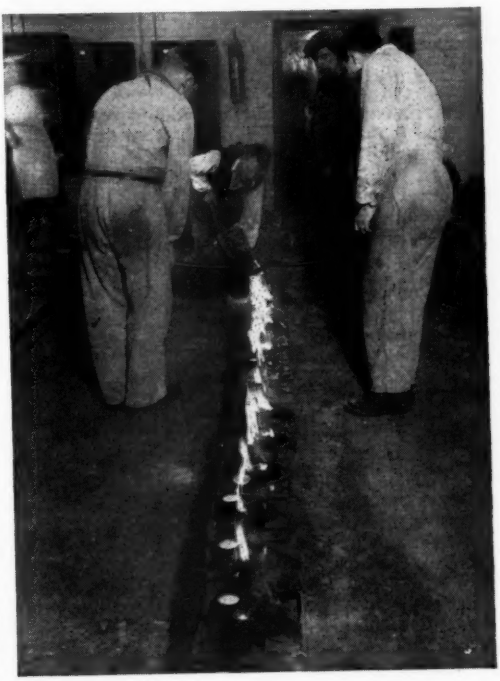
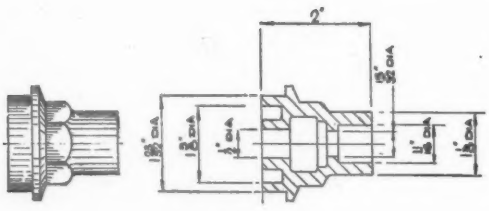


FIG. 3.—*Pouring a Batch of Assembled Shell Moulds. The Horizontally-placed Moulds are very simply supported* without *any Backing Material.*



Valve Top—Gunmetal.

Dimension, in inches.	Accuracy, in inches.	
	Shell moulding.	Sand casting.
⅞-in bore	0.0035	0.031
1¼-in. bore	0.001	0.020
¾-in. bore	0.002	0.062
Parallelism of hexagonal flats	0.0025	0.010

FIG. 4.—*Comparison of the Accuracies obtainable when the Same Casting is produced by Shell Moulding and Conventional Methods.*

ciable improvement on that obtainable on sand castings, whilst on the vast majority of metals, such as cast iron, brass, gun metal, etc., the finish is very little short of that obtained on die-castings. This high finish and accuracy leads to one of the big advantages of shell moulding, in that many machining operations can be reduced or entirely eliminated.

Relative Costs

The relative costs of shell moulding versus conventional moulding can be judged from the following example of a cast-iron valve shield which was first cast by conventional methods before shell moulding was adopted:—

Shell-moulding by Hand.	s.	d.
Coremaking, 3 min. at 3s. 8d. per hour ..		2¼
Moulding, 4 min. at 3s. 8d. per hour ..		3
Assembly, 3 min. at 3s. 8d. per hour ..		2¼
Overheads at 150 per cent.		11¼
	1	6¾
Add, Extra cost of Polygram binder	2	0
Total	3	6¾

Previous Hand-moulding Method.	s.	d.
Coremaking, 4 min. at 4s. 4d. per hour ..		3¼
Bench moulding, 20 min. at 4s. 4d. per hour ..	1	5
Overheads at 250 per cent.	4	4
Total	6	0¼

This example shows some of the typical advantages of the shell-moulding process. The first of these is a reduction in overheads, since shell-moulding requires only a simple sand mixer, a dump box and a curing oven in place of moulding boxes, sand drying and mixing plant, core-drying stoves, moulding machines and overhead cranes and heavy lifting gear. This tendency is also helped by the fact that the ratio of floor-space required to produce a given weight of castings is roughly four times as large in a normal sand foundry as with shell moulding. Moreover, shell moulds require only 1 ton of sand compared with 10 tons in the sand foundry, so eliminating labour, conveyors and overhead hoppers. To take this a stage further, a sand foundry mould measuring 9 by 9 by 4½ in. weighs about 60 lb. including the boxes, whereas a shell mould of the same size weighs 2¼ lb. (a weight saving of 96 per cent.). The cost of transporting these moulds to the pouring area will be less for shell moulding, whilst knock-out and shot-blasting plant are not required.

Other Economies

There is also a saving in direct labour costs, since the shell-moulding process can be operated from start to finish by entirely unskilled labour, even, in many cases, by women. The reduction in manual labour also renders conditions in foundries using this process more congenial. Finally, there is a greater yield of castings by shell-moulding. Better feeding is made possible by the high permeability of the thin shell and by the smooth, dry surface of the mould, whilst a reduction in surface friction means that smaller ingates, runners and risers may be employed. Taking iron as an example, a recent test over a number of days showed a yield of 85 per cent. of finished castings to metal poured, using shell moulding, as against an average yield on normal sand castings of nearer 70 per cent. The increased accuracy of the shell-moulding process also means that smaller allowances for machining need be left, which is particularly important in the more-costly non-ferrous metals.

On the metallurgical side, a casting made in a shell mould has a much lower Brinell hardness number than if cast in green sand. The mould, being completely dry, prevents chilling and the occurrence of hard spots. This leads to an extremely homogeneous metal structure, even in thin section such as are met with in toothed and finned components. Little loose sand is possible in a shell mould, due to the finally cured structure and the general physical properties of castings made by the process can be taken as representing a greater ultimate tensile strength, similar yield point and greater elongation than similar castings made in a normal sand foundry.

A NEW BOOKLET on careers in engineering, has been published by the Engineering and Allied Employers' National Federation, Derby and District Association. A copy of this booklet may be obtained free from the secretary, 102, Friargate, Derby.

SHAW FOUNDRY COMPANY, Water Glade, Willenhall, have now completed their mechanization programme, the cost of which has been in the region of £45,000. In addition, employees' interests have been catered for by the provision of shower-baths, and clothes lockers.

ADDRESSING members of Middlesbrough Rotary Club, Mr. W. W. Stevenson, chief metallurgist of Dorman, Long & Company, Limited, referred to the fact that considerable quantities of Tees-side steel were supplied to Sheffield re-rollers, and expressed the opinion that this was due to the fact that Tees-side steel contained a bigger percentage of pig-iron than steel made in other areas. There was nothing as good as the virgin material, he stated, and Middlesbrough had a great reputation for the inherent qualities in the hot-metal type of material it manufactured.

Zinc and Aluminium Die-casting

Report of the Productivity Team

A team representing the zinc and aluminium die-casting industry visited the U.S. during 1951 under the auspices of the Anglo-American Council on Productivity and E.C.A. (now M.S.A.). The team, which was formed at the joint request of the Zinc Alloy Die Casters' and Light Metal Founders' Associations, has now issued its report. Some 18 plants visited included ten pressure die-casters in zinc alloys, six pressure die-casters in aluminium alloys, five gravity die-casters in aluminium alloys, two equipment manufacturers and one specialist plating plant. The team also had discussions with the staffs of the leading U.S. associations in the die-casting field and met many trade-union officials.

The report states that the output of both zinc and aluminium pressure die-castings per head of the population in the U.S. is about two-and-a-half times that in the U.K., but in gravity die-castings the position is different, the U.S. output per head of population being only 70 per cent. of that in the U.K. and its field of application less extensive. A statistical comparison between productivity levels in the two countries was, unfortunately, not possible but the team concludes that in specific cases output per man-hour is some 30 to 40 per cent. higher in the U.S. for zinc alloy die-casting and 20 to 25 per cent. higher for aluminium pressure die-casting. In the case of gravity die-casting, the plants visited were either small or were operating at reduced levels and they were too few in number to be safely regarded as representative of this section of the American industry. The techniques employed differed somewhat from those practised in the U.K. and it is the team's impression that British methods have reached a superior stage of development.

The team found that wide use was made of incentive schemes, while neither management nor unions tolerated inefficient workers. Great efforts were made to effect maximum utilization of plant and labour and the division of labour was effected on rational lines to ensure that physical and mental energies were not dissipated on irrelevant tasks. The American die-casters make much wider use of unit dies, by this means considerably reducing the ratio of die-construction and setting-up times to production time. Die costs and construction time are materially reduced by the availability of standard die components marketed by special manufacturers.

Great importance was attached to the control of metal temperatures and to achieving a satisfactory thermal balance in dies so as to maintain the desired die temperatures.

Layout was designed, in the majority of cases successfully, to permit direct and uninterrupted flow of work from the material intake to the dispatch departments. Efficient handling of work was found to be a particular feature of the American plants.

Copies of the report may be obtained from Anglo-American Council on Productivity, U.K. Section, 21, Tothill Street, London, S.W.1, price 4s.

De Renzi, Holmes & Company, Limited, Fox's Lane, Wolverhampton, have issued some very interesting details about their "Auto-Cam-Tractor" system of controlled acceleration for crane hoisting motors and the "Hilotrol" method of creep speed control. This is a subject of great importance where foundries use an overhead crane for assembling moulds and the like. It is suggested that interested readers should write to Wolverhampton for a copy of these documents.

Increased Production from a Lancashire Foundry

Target, a newsheet issued by the Ministry of Labour and National Service, has for nearly six years been devoting its space to examples of industrial productivity. In its current issue, a short article is devoted to an example from ironfoundry practice. Below is printed the article *in extenso.*

Foundry Production Up—Man-hours Down

Since 1946, output has been increased by 25 per cent. and working hours reduced by 20 per cent. per ton of output at the foundry of the National Gas and Oil Engine Company, Limited, Ashton-under-Lyne, Lancashire. This well-equipped foundry produces castings at the rate of 5,000 tons a year.

A sand-reconditioning plant for use with a battery of six large pattern-draw moulding machines has several interesting features, including a battery of gas-fired continuous mould-drying stoves of the "tunnel" variety, designed and made in the works. "Tunnel" stoves ensure a continuous flow of moulds from the machines to the casting floor, without the congestion experienced with batch-type stoves.

The installation of a two-ton knock-out with sand storage and reconditioning plant makes it possible to employ only two men (previously there were six) on box and sand return to the moulding machines. Pneumatic jacks for removing turn-over boards from boxes before they enter the stove have dispensed with the need for crane lifts.

The amount of sand to be rammed and the need for loose reinforcing pieces is reduced to a minimum in the specially-designed moulding boxes for floor-moulded work.

Pattern Jigging

Patterns are now mounted on false boards for machine moulding. The boards are fixed in metal jig frames carrying box-location pins and are attached to the machine tables. The old method necessitated having numerous elaborate and expensive pattern boards. The machine operator can now carry out his pattern changes in a matter of minutes. The false boards are secured by screws to the master board carrying the jig frame. They rest slightly below the frame level, and when rammed, the sand is just above the box edge. This gives a close joint when the two halves of the mould are brought together. A similar system is employed on smaller machines making green-sand moulds, but a dividing rib in the centre of the jig frame enables both halves of the moulds to be produced simultaneously on the same machine.

The pouring basin is integral with the mould when patterns for liners and pistons are constructed. This saves time in preparing the mould for pouring and provides a dry and clean basin for entry of the metal, obviating the risk of loose sand getting into the mould.

The foundry is served with compressed air and gas mains running the full length of each bay. Service pipes and connections are taken off at each main building stanchion for cleaning purposes and for local drying.

High-pressure water jets, mixed with sand, remove cores from castings in about one-sixth of the time taken by the old hand method.

A correction is announced in the programme of the West Riding of Yorkshire branch of the Institute of British Foundrymen. The "Flow of Metals" film will be shown on December 13 and not on December 6 as previously shown.

Birmid Industries Progress

Group sales of Birmid Industries, Limited, are up by 21½ per cent. in value in the year ended July 31, 1952, as compared with the previous year, Lord Burghley, chairman of the company, states in his address to shareholders which he will present to them at the annual general meeting on Friday, December 12. The general rate of the combine's progress is shown, Lord Burghley states, by the fact that the sales value for 1951-52 is nearly double what it was five years ago in 1947-48.

Referring to the Group's iron foundries, the chairman says that they have met with supply difficulties in respect of pig-iron and coke and while no serious curtailment of production followed, temporary use of inferior materials, owing to shortages, has sometimes caused unnecessary trouble and loss. He regrets that the keen competition among pig-iron and coke producers, which existed up to 1939 has now virtually disappeared with adverse effect on specialized foundries.

Reference is also made to the fact that the directors have recently allocated an adequate building to house a group development establishment, known as Birmidal Developments, Limited, to which group companies will be able to remit any development programmes which they are unable to cope with, while any innovations from other sources will be studied and, if promising, accepted for following up. Labelling E.P.L. as "yet another example of financial phlebotomy," Lord Burghley strongly urges that action should be taken to relieve the taxation burdens before much of British industry is seriously crippled. As compared with the previous year the net profits for the company for 1951-52 show an increase of £112,709.

Metal Industries' Holding

The board of Metal Industries, Limited, announce that a policy decision of the directors to adjust at a suitable time the amount of the company's investment in ordinary stock of the British Oxygen Company, Limited, to a sum deemed appropriate in relation to the capital required for advancement of the trading interests of Metal Industries group, has been implemented on the opportunity afforded by the issue for cash of ordinary share capital issued on November 7 by the British Oxygen Company and following upon its recent issue of bonus ordinary shares. Arrangements for placing have now been completed of British Oxygen ordinary stock and new issue rights, with an investment group on satisfactory terms resulting in a capital profit, and leaving a holding of £1,500,000 British Oxygen ordinary stock to be shown in the company's next balance sheet at March 31, 1953 (against £1,100,000 at the same date in 1952).

"THE STEEL INDUSTRY tells me that it confidently expects next year's steel output will be about 1,000,000 tons higher than it has ever been before," said the Minister of Supply, Mr. Duncan Sandys, speaking in the debate on the Iron and Steel Bill in the House of Commons recently.

AN ORDER HAS BEEN RECEIVED by Brockhouse Engineering (Southport), Limited, for more than 1,000 agricultural tractors for Turkey, the value of the contract being about £500,000.

United Steel Staff Recruitment

A publication dealing with the recruitment and training of senior staff has been issued by the United Steel Companies, Limited, Sheffield. As an indication of general policy, it is stated that the scheme is founded on a long-term view of the firm's requirements. Its principal aim is to ensure that staff vacancies will be filled as they arise by men of the right quality, the majority of the appointments being made by promotion from within the company's organization. To meet this the staff must consist of individuals at different levels of age and progress, and with sufficiently varied potentialities to provide for all needs.

Staff recruitment is therefore planned with a view to securing an inflow of new entrants from whom there will emerge individuals who will in time be capable of filling the highest executive positions. Thus, anyone who is appointed to the senior staff may be satisfied that, if he has the appropriate ability, good prospects will arise for him.

The recruitment and training for senior staff, however, is only one part of the concern's training policy, which includes selection at various levels of entrants to its employment, with appropriate training thereafter and related opportunities for further education. Some 30,000 people are employed and the United Steel undertakings provide wide scope for the exercise of varied ability and skill and ample opportunity for those who have the aptitude for positions of responsibility.

Iron-ore Imports

Imports of iron ore in October and the total for the 10 months of the year to date, with comparative figures for 1951, are shown below.

Country of origin.	Month ended October 31.		Ten months ended October 31.	
	1951.	1952.	1951.	1952.
	Tons.	Tons.	Tons.	Tons.
Sierra Leone	73,550	79,400	491,359	659,191
Canada	115,067	65,605	537,057	603,742
Other Commonwealth countries and the Irish Republic ..	9,280	32,220	37,409	50,102
Sweden	324,517	296,391	2,868,709	3,030,421
Netherlands	5,751	5,437	40,435	36,635
France	21,927	38,243	297,281	355,164
Spain	76,350	45,496	678,601	589,764
Algeria	136,868	136,289	1,204,402	1,436,494
Tunis	49,670	55,580	421,146	488,139
Spanish ports in North Africa	23,150	10,500	285,251	224,888
Morocco	24,450	25,900	231,333	258,669
Other foreign countries	9,880	61,363	168,543	443,692
TOTAL	870,460	852,424	7,261,526	8,176,901

Tees Ore Trade Increases

The port of the Tees, which previously ranked as the leading British centre for the import of foreign ore, set up a new record in the 12 months ended October 31, when imports of all commodities amounted to 3,643,634 tons. This figure included 2,838,959 tons of foreign ore.

Exports increased by 44,000 tons to 1,490,000 tons, but this was only about half the record export figure reached in 1907.

Economies in the Foundry

(*Continued from page* 630)

Rational Founding

Concealed by the somewhat uncompromising title of "Rational Foundry Management," Mr. F. Buckley commenced the afternoon with a really inspiring talk on the conversion of a large foundry to modern production methods. The foundry described was that of the English Electric Company, Limited, at Rugby, and to give his listeners an idea of the sort of work involved, Mr. Buckley first illustrated some typical ranges of castings produced there, varying in weight from ½ lb. to 30 tons, some with very complicated cores.

The new scheme was envisaged to double the former output, with little increase in floor space or labour. Next were shown slides of the old layout and of the new system developed on "flow-line" principles, introducing a Hydroblast plant for cleaning, complete internal rearrangement of plant and processes as well as relegation of moulding to machines and unskilled labour. Smaller jobs were eliminated and their production in one of the other foundries of the company was undertaken. Medium-size castings (in ranges from one to 20 off), suitable for production in boxes up to 6 by 4 ft., were then rigged for production on two jolt-rollover machines. A flow pattern was retained by feeding jigged pattern-plates into the system. Larger jobs were prepared for moulding on specially-built Pneulec machines for the turn-over and patter-draw, and the ramming was done by mobile Sandslingers, having a capacity of 14 tons. This group included castings requiring a box size of 8 by 3 by 3 ft. and weighing up to, say, 2 tons each. Patterns were jigged in this case also.

Heavier Castings

The most revolutionary development concerned the very heavy castings, weighing on average 14 to 20 tons, which had previously been loam moulded by conventional hand methods. These were set-up for moulding in sections in quite shallow box-parts by splitting the full pattern into slices horizontally, rather in the manner one would expect from a large bread-cutting machine. Each "slice" of the pattern was accurately dowelled on plates so as to take its relative place in standard-depth moulding boxes and subsequently in the complete assembly. Mould sections were rammed by Sandslinger and dried overnight, thus making possible the production of a 14-ton, intricate casting in five to six days.

Ancillary Operations

Production of the large cores for such jobs was mechanized by utilizing Sandslingers and a turnover-draw machine—one such had a capacity of 10,000 lb. on a 7- by 5-ft. table. A minimum number of core-irons was employed and all-sand construction was followed for the cores. Quite a difficult problem was posed by the desire to standardize on a single type of moulding sand for all the work and, finally, a synthetic sand was chosen containing a proportion of pelletted pitch. This eliminated scabs and buckles and the moulds, after only a short drying, could be closed and cast the same day. To standarize on a single basic metal composition also brought a number of difficulties, but these were overcome by melting but one iron and modifying as required in the ladle. A new cupola plant was installed for this purpose. For the knock-out and cleaning, mechanical shake-outs of the direct type were installed to work in conjunction with a Wheelabrator for smaller work and a two-gun Hydroblast for the large jobs. The latter plant incorporated full treatment and reuse of the filtered water. It was early found that ordinary box-parts were for the most part too heavy for the new set-up, and the special shallow boxes, even for the largest jobs, were then fabricated from comparatively light rolled-steel sections. These proved eminently satisfactory.

Production Planning

A comprehensive system of controlled budgetary planning and shop-loading was introduced as complementary to the new operation schedules, for the machine-shop requirements of the firm were based on rigid time schedules. This involved the pre-planning of the total production of over 100 tons per week. At the order stage, jobs were allocated to the sections and the moulding programme was fixed months ahead—made possible by a very effective liaison between the staffs of all departments. The four features stressed throughout the scheme were:—(1) Inculcation of the necessary revolutionary attitude by the management; (2) proper servicing of the machines; (3) adoption of box moulding even for the largest jobs, and (4) pursuit of the unconventional to provide an outlet from the rigid limitations imposed by tradition. In the summation, not only had the desired ends listed earlier been well realized, but working conditions had been much improved (partly as a result of concreting 98 per cent. of the foundry floor); dirt, disorder and untidiness were banished and production times were now unmatched anywhere in the world.

It was evident from the animated discussion that followed Mr. Buckley's account that members were much impressed. Additional information gleaned included the following:—Oil-bonded sand was used for the production of cores by Sandslinger; the larger jobs were cast in shallow pits; pattern sections for big castings were matched with the box-parts, which were edge-machined, and the pitch-bonded sand had a high green-strength; cost of production compared favourably with any other methods for such jobs despite heavy allowances for capital depreciation; mould movement was on sloped gravity roller-track for up to 6- by 4-ft. boxes, but was

power-assisted for the larger boxes and, finally, feeding was assisted by employing an exothermic powder.

Psychological Aspects

"From fact to fantasy" might have been the effect of the transition from the last Paper to the talk which followed next on psychological aspects of foundry management by Dr. A. A. White (full-time medical officer, Austin Motor Company, Limited). Yet it was soon clear that the first dealt with results and the second with the motive forces at work to produce those results. Dr. White "debunked" much that had been written on the subject of management psychology, which he described as being the emotional relationships between men, their employers, their managers and their foremen, and its inter-weaving with their own home life. This latter factor might, in a set circumstance, be of major importance and yet represent an "unknown" to the man concerned with production in the factory. Often, the inculcation of a sense of participation among workpeople caused an increment of productivity. It was well realized that man's fundamental instinct was to form groups and that extremes of behaviour were often group reactions, which could be extended with a "singlemindedness," unity of purpose, and fanaticism extending beyond the individual feelings of single members of the group. Such groups of workpeople were most difficult for a manager to deal with, and only by getting instructions to seem to appear from within a group could he win sympathy. In such cases, enthusiasm followed automatically—but the same process worked both ways.

Dr White then surveyed the whole field of aptitude tests, which had proved valuable in preventing misfits when applied during the war to military matters and were being extended with some success in industrial spheres. Managers should develop a special philosophy in their relation with staff and should call in assistance from skilled psychiatrists when in difficulty. Of a manager's skills in dealing with his fellows, some were inate and some could be acquired. In cases of discontent, the psychological cause (which was always present) should be sought and, conversely, sources of contentment should be explored and exploited. For example; the fear of contracting silicosis was perhaps part of the emotional background of a fettling-shop worker, but by mass radiography the emotional tension very largely could be removed.

The "armoury" at a manager's disposal was investigated still further in the discussion following Dr. White's paper, but it seemed clear from the remarks that a manager was "born," not made. In reply to a question on recommended medical examinations and as to whether a man's integrity, energy of application or just simply his "guts" could be assessed by any tests, Dr. White replied that if a job had any health hazard, then he recommended a full medical examination be made of a man before commencing work and, as well, periodic re-examination afterwards. Tests were, he said, being devised to assess "guts," drive and initiative. For young entrants to a trade, a vocational guidance test was suggested, but with older men continuing their own line, no tests were necessary when they entered other employment of a similar nature.

Work Simplification

Continuing the afternoon session, Mr. W. Y. Buchanan took the chair for a paper by Mr. W. Rodgers, of the D.S.I.R. (and formerly head of a department of Acton Technical College), entitled "Work Simplification." This he described as a four-stage process to prepare an ordered approach for providing an efficient basis for the engineering of effective working methods. He then circulated amongst the audience a chart showing these processes—"analysis," "synthesis," "standardization" and "to establish time"—as well as the subdivisions into which each was split.

Analyses, the Author said, were of two types, primary and secondary, the first of which was intended to identify what was going on in a general way with operations in a workshop and to separate glaring errors. Always, the Author explained by way of example, there was a danger in applying incentive schemes until basic facts had been established to enable methods to be put right first—in other words, it was necessary to replace hard work by more intelligent working. The second phase of the analysis involved detail study of movement and sub-headings here included motion-study, chronophotography, frequency studies, interfering factors and the like.

The second main phase, synthesis, was briefly to use existing basic data to evolve a better scheme. It was a question of employing trained minds (sometimes fresh to a given location), as well as imagination and general experience of industry and parallel set-ups. The third section, standardization, embodied the establishment of the synthetic method to be in sympathy with its surroundings, taking into account such things as uniformity of materials, human factors and job evaluation.

The final process—to establish time—was of lesser importance once the preceding operations had been established. It involved the intelligent application of time-studies to the job on hand, surveying the range covered, application and analysis of waiting time and all other allowances. The Author contended that all this work could best be handled by some outside body with a detached viewpoint. The logical extension of this work was the synthesis of operational times from elemental times for given movements, which could be welded together to cover a given job.

A film was then shown and, after that, there was possible only a short discussion of this paper, owing to time limitations. It was clear that the meeting was not wholly in support of the theoretical build-up as a substitute for long experience by practical men in assessing the worth of a job. Nevertheless, the chairman endorsed the Author's scepticism of some incentive schemes by saying that preplanning was better than bribery.

Magnetic Recovery

The concluding Paper of the session was a short illustrated talk by Mr. T. G. Hawker (Rapid Magnetic Machines, Limited) on the magnetic recovery of scrap metal from sand. This first reviewed the standard designs available for both electro-magnetic and permanent-magnet plant for the job as well as a number of "specials." In discussion it was disclosed that magnetic recovery was feasible for conveyor-belt speeds up to 240 ft. per min. carrying sand up to 3½ in. deep.

In the late evening, the film "External Dust Control for a Pedestal Grinder" was shown—a record of co-operative work on dust-extraction problems by Mr. W. H. White, of the Association, and Mr. W. B. Lawrie, of H.M. Factory Inspectorate.

Swarf Utilization

The most controversial subject of the conference—utilization of borings and swarf in the cupola—was the subject of two papers when members reassembled on the Wednesday morning for the final session, with Mr. R. L. Handley occupying the chair. First, Mr. W. H. Bamford recounted how his firm, Austin Motor Company, Limited, had for several years used their own arisings of swarf packed into cans and charged direct by hand into the cupola. The cans were fabricated from spot-welded scrap sheet steel, also arising in the works, and closed by bending over after inserting a disc in the top; 25 per cent. density was obtained by hand packing. Mr. Bamford had proved that these cans of swarf were the last of the charge constituents to melt. Melting loss averaged 10 to 15 per cent. and there was greater erosion on the lining than when no swarf was used. Metallurgically, the borings behaved in a similar manner to a steel addition—they were instrumental in producing lower carbon melts and, of course, themselves lost silicon substantially. From a cost point of view, his figure for 1948 prices (based on 40 lb. swarf per canister) were:—

	Shillings.
56 canisters at 3.62d. each	16.9
0.75d. each for filling	3.5
1 ton swarf	47.0
50 lb. ferro-silicon	12.5
Total per ton charged	79.9

For comparison, to use steel scrap as an alternative cost 71s. per ton for the steel plus 30.75s. per ton for ferro-silicon. Two peculiar facts associated with the use of borings were: (*a*) that centrifugal castings made from such metal showed pin-holing, and (*b*) when the metal was transferred for steelmaking in a Tropenas converter, a "wild" heat resulted. Nowadays, his firm could not provide the necessary scrap steel for the canisters and future use was to be made of the briquetting process.

Mr. Bishop (Metal Box Company) added further information at this juncture on the canister method. He disclosed that 13 or 14 foundries were using 20-lb. capacity cans purchased at about 7d. each from his firm. These cans were sealed by a machine after filling with swarf, the machine being on hire.

The chairman then outlined his own varied experiments with swarf utilization, ranging through cement bonding; using tins, the price of which had now risen to 8d. each; continuous melting in a crucible with a hole in the bottom; a rotary hearth and, finally, his most successful practice of using a special 24-in. dia. cupola for melting borings only.

The "Croft Process"

After considerable further discussion on details of the canistering process, Mr. D. W. Hammond gave his Paper on the "Croft Process."* This method he and his colleagues had devised for melting borings by injecting them into the cupola furnace just above the melting zone by means of a mechanical contrivance of the ram type, operated by compressed air. First, he dealt with cupola reactions and the reasons for placing the borings at this point in the burden, and then followed by describing the plant itself in some detail, its *modus operandi*, metallurgical considerations, and the economies to be secured in actual operation.

Once more, the considerable discussion showed the awareness of founders of the potential savings to be secured themselves by using borings instead of selling them or discarding them. Such topics as slag analyses, installation costs, explosive possibilities, melting rates, cupola patching, and the cumulative effects of sulphur were among those exhaustively dealt with.

B.C.I.R.A. Advisory Service

By way of winding-up the conference proceedings, Dr. J. G. Pearce spent the closing period of the morning in outlining ways in which the British Cast Iron Research Association can be, and is, of great service to members in an advisory way, not only with proposals concerning foundry economy, but a host of others. Confidence was carefully respected with regard to reports on problems submitted and on the reports of the Association's operational research team, which was being increasingly called upon to visit founders and advise on both major and minor reconstruction or rehabilitation schemes. Then, there was the scheme by which foundries sent members of their staff for specialized training at Association headquarters—recently 100 such had been instructed in sand control principles and practice.

Future Subjects

The remaining few minutes of the session were occupied in receiving suggestions from delegates as to subjects for future conferences (this was the ninth which had been held since the war). Education, permanent-mould techniques, productivity, management, scrap and its elimination were among the proposals forthcoming. It was very clear, said the chairman, in closing the conference, that a very worthwhile purpose was being served by such meetings—as was borne out by the high attendances—and he proposed a vote of thanks to the organizers, the director and staff of the Association. This was carried with applause.

Full reports of this Conference will be issued by the British Cast Iron Research Association in its *Journal of Research and Development.*

* Details printed in the JOURNAL, April 10, 1952, p. 389.

Pig-iron and Steel Production

Statistical Summary of September Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the previous six months; Table II gives production of steel ingots and castings in September; Table III, deliveries of finished steel; Table IV gives the production of pig-iron and ferro-alloys in September, and number of furnaces in blast. All figures in thousands of tons.

TABLE I.—*General Summary of Pig-iron and Steel Production. (Weekly Average.)*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.[3]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1950	249	174	197	185	197	9	313	241	997
1951	284	170	206	186	175	8	301	243	589
1952—April[1]	305	184	224	201	171	29	305	248	576
May	326	183	231	201	174	45	312	264	586
June	310	186	231	200	170	43	313	258	663
July[1]	306	194	233	202	150	38	274	225	768
August	300	194	232	202	151	31	280	215	823
September ..	318	198	234	209	184	30	330	—	789

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in September*, 1952.

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex ..	—	3.4	11.2 (basic)	1.9	0.2	15.6	1.1	16.7
Lancs. (excl. N. W. Coast), Denbigh, Flints. and Cheshire	1.7	19.8	—	2.0	0.6	22.9	1.2	24.1
Yorkshire (excl. N.E. Coast and Sheffield) ..	—	34.6	—	—	0.1	34.6	0.1	34.7
Lincolnshire	2.2	56.8	—	1.3	0.5	58.9	1.9	60.8
North-East Coast	4.3	35.9	—	1.6	0.8	40.4	2.2	42.6
Scotland	—	17.0	—	1.1	0.7	17.0	1.8	18.8
Staffs., Shrops., Worcs. and Warwick	6.9	62.7	5.5 (basic)	1.3	0.1	75.8	0.7	76.5
South Wales and Monmouthshire	10.1	27.4	—	9.8	0.6	45.6	2.3	47.9
Sheffield (incl. small quantity in Manchester) ..	0.6	1.5	5.1 (acid)	0.4	0.1	7.5	0.2	7.7
North-West Coast								
Total	25.8	259.1	21.8	19.4	3.7	318.3	11.5	329.8
August, 1952	18.5	222.9	20.9	14.2	3.0	270.6	8.9	279.5
September, 1951	25.1	234.8	22.5	16.9	3.6	292.9	10.0	302.9

TABLE III.—*Weekly Average Deliveries of Finished Steel.*

Product.	1950.	1951.	1951. Aug.[1]	1952. July.[1]	1952. Aug.
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	3.6	4.0	3.4	3.5	4.2
Heavy rails, sleepers, etc. ..	11.3	10.1	7.1	10.2	8.4
Plates ⅛ in. thick and over ..	40.0	41.0	33.9	35.7	35.2
Other heavy prod.	40.2	39.9	34.2	29.5	37.5
Light rolled sections and bars ..	47.6	47.1	36.9	40.9	40.4
Hot rolled strip ..	19.4	19.5	15.7	16.3	16.0
Wire rods	16.3	16.1	13.5	11.7	16.1
Cold rolled strip ..	5.5	6.0	4.7	5.5	5.2
Bright steel bars ..	6.3	6.6	5.3	5.8	5.1
Sheets, coated and uncoated ..	30.5	30.4	26.2	31.2	25.4
Tin, terne and blackplate ..	14.3	13.8	10.2	16.2	12.1
Tubes, pipes and fittings	20.0	22.0	16.3	20.8	18.7
Mild wire	12.5	11.9	9.2	10.3	11.7
Hard wire	3.5	3.7	2.6	2.8	3.1
Tyres, wheels and axles	3.5	3.7	2.5	3.5	2.5
Steel forgings (excl. drop forgings) ..	2.2	2.3	1.9	2.4	2.9
Steel castings ..	3.5	3.8	3.9	4.2	4.2
Tool and magnet steel	[7]	[7]	[7]	0.5	0.4
Total	280.2	281.9	227.5	251.0	249.1
Alloy steel	10.6	12.3	9.6	14.1	12.6
Total deliveries from U.K. prod.[5] ..	290.8	294.2	237.1	265.1	261.7
Add: Imported finished steel ..	3.8	4.9	3.8	15.6	12.9
	294.6	299.1	240.9	280.7	247.6
Deduct: Intra-industry conversion[6] ..	55.6	58.3	50.8	57.8	62.0
Total net deliveries ..	241.0	242.8	192.1	224.8	214.5

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys in September*, 1952.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys	Total.
Derby, Leics., Notts., Northants and Essex ..	25	—	16.7	23.1	2.1	—	41.9
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	6	—	8.9	—	—	0.7	9.6
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	13	—	28.9	—	—	—	28.9
Lincolnshire ..	25	7.5	41.4	0.2	—	1.6	50.7
North-East Coast	9	0.8	13.1	3.2	—	—	17.1
Scotland							
Staffs., Shrops., Worcs., and Warwick ..	8	—	8.2	1.6	—	—	9.8
S. Wales and Monmouthshire	9	3.0	31.0	—	—	—	34.0
North-West Coast	8	15.3	—	0.2	—	1.1	16.6
Total ..	103	26.6	148.2	28.3	2.1	3.4	208.6
August, 1952 ..	105	26.8	141.9	28.4	1.2	3.6	201.9
September, 1951	102	27.2	129.7	27.9	1.6	3.1	189.5

[1] Five weeks.

[2] Weekly average of calendar months.

[3] Stocks at the end of the years and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] i.e., Material for conversion into other products also listed in this table.

[7] Included with alloy steel.

Gas-appliance Manufacture and the Enamelling Industry

*Extracts from the presidential address by Harold Hartley, C.B.E., D.Sc.**

During his 40 years in the gas industry, the president has had experience of the art of enamelling as practised by that industry. He therefore reviewed developments which have taken place in the design and production of the gas cooker during the present century; both because these developments have had marked influence on the art of enamelling, and because they provide an interesting example of the effects of the application of scientifically-acquired knowledge on the development of an industry.

The president began by saying that to-day the vitreous enameller is intimately concerned with the activities of the gas-appliance manufacturers. If, at a later date, it should happen that vitreous enamels were no longer required in that domestic field, then there might be a serious recession in the industrial demand for the materials; that in its turn would be a serious matter for many of the members of the Institute of Vitreous Enamellers who must be concerned to see that knowledge is acquired which will enable them to convert their own art into a science.

Early Art of Cooker Manufacture

The first types of gas cooker were produced as alternatives to existing coal ranges, and their form was derived directly from the arrangement of the latter. The hot-plate was placed above the oven, but coal-gas was used to provide the heat needed. Initially, the gas was burned so as to give luminous flames, but after the invention by Bunsen of his burner, advantage was taken of this means of producing aerated flames. The adoption of the Bunsen burner must have made immediately possible marked improvement in the utility of the appliance.

At the end of the last century, the constructional methods in use were still elementary, and the design of the parts was determined by the possibility of making castings which could be fitted together. There was no machining, except for the drilling of the flame ports of the burners and the tapping of gas rails; the main castings of the structure were held together by the use of cast-in nuts and screws. It was only in the more expensive types that insulating materials were used for the oven, and it was at this stage in the evolution that sheet-steel interiors, with a protective coating of enamel, were first adopted. One well-known single-cased cast-iron cooker was still supplied in appreciable quantities even at the beginning of the second decade of this century. Several of the better-known appliance manufacturers in turn supplied these cookers at cut prices, regarding the business only as a useful means of reducing foundry on-costs.

Any sealing of the joints between the parts was done in a perfunctory manner, and it is questionable whether much fuel economy resulted at first from insulating the oven. The speaker well remembered about this period being told by a works engineer of a great invention he had made, namely, the design of a type of gas-oven which consumed its own products of combustion. The simple expedient had been adopted of closing the flue outlet with a piece of sheet iron—leakage through the joints of the structure was such that the burning of the flames was not visibly affected.

This state of affairs continued until, at the beginning of the second decade of this century, the manufacturers began to realize that if their industry were to develop in the way they desired and the gas industry were to be given the service it would need for full development, the problems to be solved in designing and making improved appliances would have to be investigated in a scientific manner. One of the early steps taken by the manufacturers was to engage on their staffs scientifically-trained men with a specialized knowledge of the phenomena of gaseous combustion and fuel utilization. This step followed as the direct result of research work which had been carried out at Leeds University on the initiative of the Institution of Gas Engineers, to devise a means of assessing the thermal efficiency of the gas fire.

Influence of New Outlook

The men employed were primarily physical chemists. On joining the industry their first task was to assess the merits of the goods which were manufactured, and then to devise means for their improvement. At the same time they had to familiarize themselves with the technology of the production processes in use. Appreciation grew of the value of the help which could be given in design by men with a scientific background. In due course, their part in the hierarchy of the industry became established, and to-day it was essential for the gas-appliance manufacturer to have an effective research and development department, not merely to keep abreast of his competitors, but to satisfy the requirements of the technicians who serve the utilization side of the nationalized gas industry.

In concluding this portion of his address, the president summarized the functioning of his Group's laboratory as:—

(1) *Background research.*—This work was carried out to obtain a better understanding of gaseous- and solid-fuel combustion, of heat-transfer problems, of burner design, of cooking results, and so on, with a view to the acquiring of knowledge which would enable better apparatus to be designed.

* Dr. Hartley was elected president of the Institute of Vitreous Enamellers at their annual general meeting held earlier this session.

(2) *Applied research.*—This was work done with actual models of parts of apparatus or complete appliances. New concepts were implemented in working models prepared for discussion with other specialists in the organization, whose knowledge was incorporated in the finished product.

(3) *Process research.*—This work was concerned with improving knowledge of the technology of works processes and the utilization of new materials.

The present-day position of the industry was then enlarged upon, the president dealing in detail with such aspects as improvements from the culinary angle; scientific developments of works processes, including control of raw materials, and finally with the service available from the modern gas-appliance manufacturer.

Improvements in Enamels and Enamelling

Dealing with actual enamelling, he said records were scanty and it was difficult to indicate the approximate date at which vitreous enamel was first used by gas-appliance manufacturers. The use of enamelled linings in cookers was not uncommon towards the end of the 19th century. The application of vitreous enamel as a protective coating made it possible for the manufacturer to employ sheet-steel for oven interiors instead of cast-iron. Although relatively costly, the inclusion of the enamelling process in the production cycle was adjudged worthwhile, having regard to the benefits which were thereby conferred both on the maker and on the user. To-day, enamelling had become one of the major processes in the manufacture of the apparatus.

The evolution of the enamelling process in England in the latter part of the 19th century and at the beginning of the present century, was in the hands of relatively few people who specialized in the subject. This knowledge, although it may have been bought at the expense of the organization employing the enameller, remained his closely-guarded secret; there was not even analytical control and the enameller depended entirely on his supplier to maintain the quality of the raw materials.

Much of the industrial enamelling then done was for the production of signplates, and no doubt in those earlier days of the gas-appliance industry, some of the same frits were used for enamelling cooker components.

It was not until after the first world war that the "wet" process for enamelling cast iron was introduced into this country from the United States. From that date, there was a big increase in the extent to which enamel was applied for finishing both the working parts and the "ornamental" parts of the domestic cooker. British manufacturers were at first dependent on the supply of frits made in the States. The enamels were "soft" and not too difficult to work and the results obtained were outwardly acceptable, in part because the standards of production were then much lower than to-day. It was found in use, however, that the enamels applied to the cast-iron parts inside gas cookers were in due course literally washed away by the action of the condensate derived from the products of combustion, and the material was also not sufficiently durable for use on the exposed working parts of the cooker. Had the American frit manufacturer, who led in this field, not asked extortionate prices for what were not good frits, and taken note of the criticisms of his enamels, he would have been able to effect such improvements as would have maintained for him in this country the leadership for many years. The unsuitability of the material, in view of the technical requirements to be satisfied, compelled the British appliance manufacturer to compound lead-free frits which could be worked by the "wet" process and which would yield to the cooker user a service such as the British gas industry could accept.

Next, the president outlined typical defects in enamelling practice and gave details of the way deficiencies had been tackled in his firm's organization, mainly by creating a section of the research and development organization which was to be concerned solely with the compounding of enamels and the improvement of enamelling technique. This was put under the charge of a high-grade man who had graduated in glass technology at Sheffield University.

Manner of Development

In the last quarter of a century, the development of enamels for use on gas cookers and the methods of application had progressed hand-in-hand with improvements in the design and production technique effected by the appliance manufacturer. It was about the beginning of this period that the first all-enamelled cookers were produced. There were then more than a thousand gas undertakings to be supplied and each manufacturer made a multiplicity of types in a variety of finishes to meet the wishes of the various buyers with whom he dealt. Progress in cooker development still depended then almost entirely on the initiative of the appliance manufacturer and the market needs precluded the adoption of the specialized production which characterized the industry to-day. This state of affairs continued until the gas industry itself was nationalized.

The shortcomings of the original cast-iron frits had led to the concentration of effort to produce stain-resisting enamels. To compound boro-silicates that would fire at the required temperature and be suitably resistant to the action of dilute sulphuric acid, lemon juice, and the like, was not difficult with the knowledge then available; what was difficult was to make frits which could be applied economically on the castings then produced. Before the desired results could be obtained it was found necessary to change the composition of the cast-iron by increasing the manganese content and limiting the

amount of silicon, so as to reduce the size of the graphite particles and avoid "burning" of the castings at the enamelling temperatures. Ultimately, mixed frits were evolved which, although not fully resistant to the action of the dilute acids, were a great improvement on the materials they replaced and the expedient was adopted of applying a light spray of a fully-resistant glaze before firing the final coat. The castings were improved for enamelling by using special sands in the moulding process on bosses where enamelling defects might occur. Later, about 1932, titanium oxide was introduced as a partial substitute for silica in the compounding of the frit itself; the production of acid-resisting materials became easier and substantial progress had been made since that date. As the stain-resisting material was also more resistant to abrasion, the durability of the enamel was much enhanced and the confidence of the gas industry in the product was ensured. To-day, the demand was for appliances with all iron and steel parts suitably enamelled and agreed physical and chemical tests were embodied in a British Standards Institution specification. (An idea of the progress made over the last 40 years could be gained by comparing Figs. 1 and 2, which showed the type of gas appliances produced in 1912 and in 1952.)

Special Enamels

During the last ten years or so, another marked development had derived from the use of titanium oxide, namely, the production of self-opacifying materials which enabled enamels to be made of high opacity and high reflectance and possessing other desirable chemical and physical properties. The need for enamels resistant to serious thermal shock had existed since the enamelled crown tray was first supplied on the gas cooker and exposed to the radiant heat from the griller in the hot-plate, and the progress made in meeting this requirement was evidenced by the fact that it was now rare for an enamel tray to fail from this cause.

The use of lithium as a constituent of frits was now growing and offered possibilities of developing more workable enamels, which could be applied at lower firing temperatures. Whilst the application of the materials lithium, titanium and so on, had been expanded on an empirical basis, much more work was being done throughout the world to build up a background of fundamental knowledge.

This recapitulation of a few of the latest developments in enamelling technique, which had been quite outstanding, gave some indication of the potentiality which this industry offered to the scientific worker. The enamelling industry had reached the point where continuing development and expansion in the face of competition from other materials depended in increasing measure on adequate scientific research. It was only prudent, therefore, to give serious thought to the means by which provision could be made to ensure not only that there should be in this country a number of centres engaged in acquiring background knowledge, but that the educational establishments should provide technically-trained men who could help to foster the development of the industry.

The Future

Although vitreous enamels had much to commend them, they were subject to certain limitations when considered in the light of the service to which they were put. Enamelled sheet-metal parts were too easily damaged in handling in the works, in transport to the gas undertaking, to the consumer's premises, or in subsequent use. The use of thinner coatings which was now practicable had done much to decrease the vulnerability of the material to chipping. Further progress in this direction resulting from improvement in frits and better production control would yield a big reward. Enamelled sheet ware was vulnerable to mechanical shock to a much greater extent than enamelled cast iron.

Here, the president went on to enumerate other desirable trends, sounding a warning note by pointing out that there was a sharp look-out being kept for developments in paints or other materials for surface treatment of metals, which would enable an attractive and reasonably durable finish to be provided. There was a search even for materials to replace metals, where in the past the use of such substances had been expedient rather than essential.

In the quarter century which had passed since the British gas industry began to adopt the sheet-steel cooker in large quantities, there had been a notable falling off in the extent to which cast-iron was used. The speaker felt that had those concerned with the expansion of the use of cast-iron paid more attention to the Cinderella of all their materials—the high-phosphorus cast-iron produced from indigenous ores—had shown greater appreciation of the significance of the enamelling process, and helped to provide solutions for the problems associated with the enamelling of cast-iron, the change-over to the lighter, ductile metal would, at least, have been less rapid.

The sales demand for white or cream finishes and pastel shades was more easily satisfied by using sheet-iron. Such a finish could be applied to cast-iron, but at a considerable cost and unless more knowledge was acquired of the causes of the troubles which were still a concomitant of the process, then the use of cast-iron would shrink still further. No industry could be satisfied to continue to accept the high financial cost of the process. Under the most favourable conditions, the production of enamelled cast-iron would probably always be more expensive than the fabrication and enamelling of sheet-iron, but such additional expense might be justified because of the greater life of the product. It might be too late already to stop the drift away from cast-iron by the gas-appliance industry—if that were so, it was to be hoped that those interested in enamelling appreciated the full significance of the lesson.

The use of sheet-iron had provided one escape outlet, but even the enamelling of that material would be dropped if the enamelling process could be replaced by one cheaper to operate and easier to control, and capable of providing a finish that would satisfy the technical standards required.

Responsibilities of the Industry

Last year, some 850,000 gas cookers and nearly 320,000 electric cookers were manufactured in this

Gas-appliance Manufacture

country, all carrying many enamelled parts. In the processing there may have been consumed something like 15 million lb. weight of enamel frits, and if that market were lost, the makers of enamels would suffer seriously. The production losses which arose in the enamelling departments cost the Group of companies, with which the president was associated, well over £100,000 a year; it would be appreciated that he would much rather such money were available for the improvement of the firms' products than have it frittered away in wasteful process operation.

With a full appreciation of the responsibilities of the position to which he had been elected, he warned those concerned with the compounding and supply of enamels that they would be wise, if they wished the trade with the appliance industries to survive, to take stock of the position and arrange mutual action to meet the potential threat.

The gas industry and the gas-appliance industry between them were steadily raising the technical standards which had to be satisfied if apparatus was to be approved for use in this country. Both parties insisted on the adoption of such a policy, realizing that if they were to meet the potential competition of other "fuels," they must provide the best service. No method of production, no assembly technique was sacrosanct; it was retained only so long as it could not be replaced by anything better. What had to be ensured by the vitreous-enamelling industry was that it was developing its practice and materials so that the service offered would be better than could be obtained in any other way.

Steelmakers' Co-operation Sought

The extent to which sheet-steel was used in the manufacture of domestic cookers was now so great as to make it worthwhile for the manufacturer of the steel to use every endeavour to produce metal particularly suited for enamelling and for the fabrication which preceded the application of enamel.

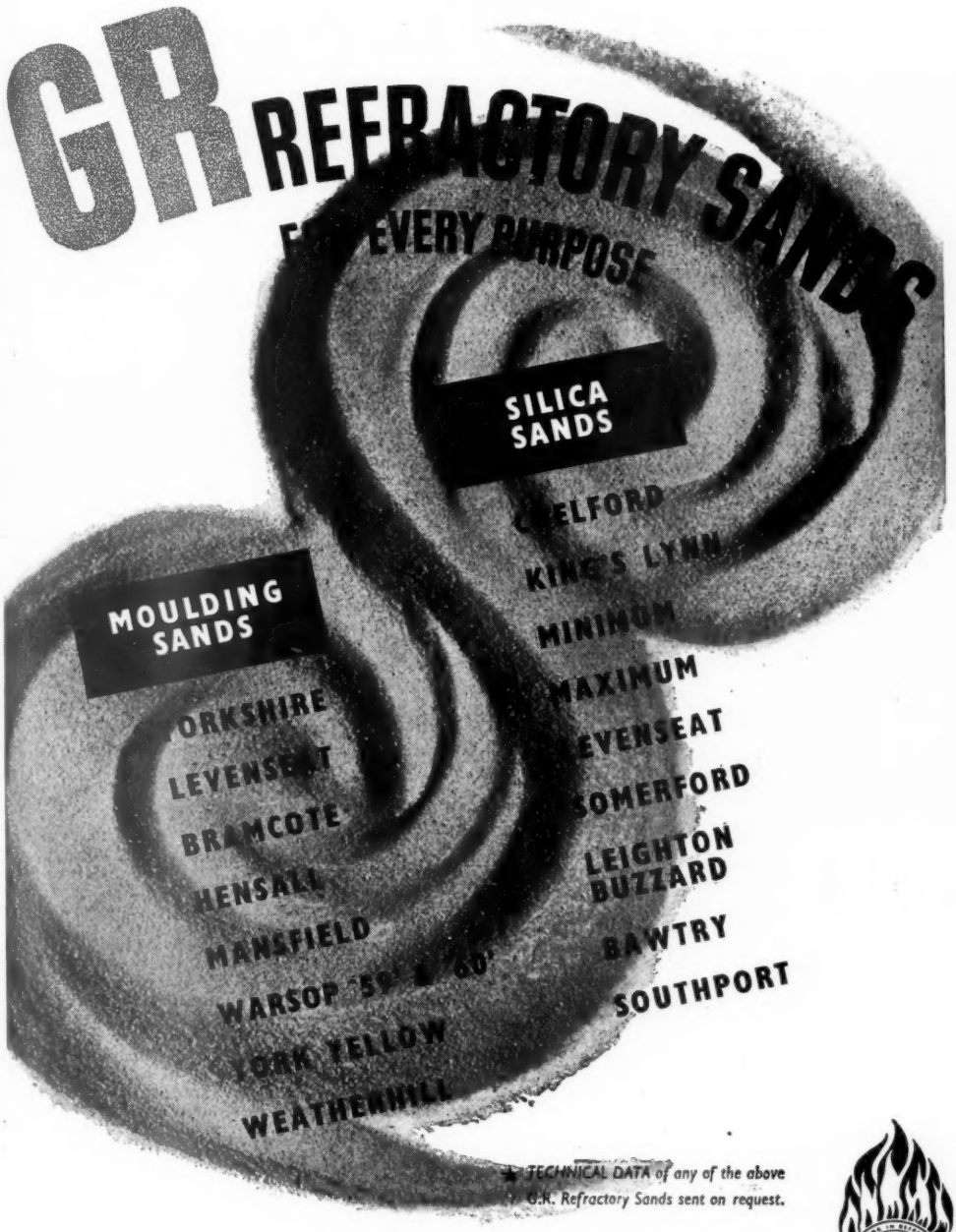
It would not be enough to continue to act to the best of one's ability as individuals, merely pooling some of the knowledge by the presentation of papers to the Institute, or by participation in discussion. A greater co-operative effort would be needed, and this would mean that more men with an adequate scientific training would have to be employed by or for the industry.

By expanding its technical functions, the Institute was rendering a good service to its members. It should act as the spearhead of a concerted effort to obtain more knowledge more rapidly by way of research and development work for the improvement of the vitreous-enamelling industry.

"1912"

"1952"

FIGS. 1 AND 2.—*Typical Progress in Design and Appearance of Gas Appliances over the last Forty Years.*



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News in Brief

IN JANUARY the Departments of Denbighshire Technical College are to be transferred to the new £500,000 college at Wrexham.

THE ADDRESS for correspondence to *Metalen*, the Netherlands metallurgical magazine, is now Ir B. Pennekamp, Nieuwe Laan 76, Delft, Holland.

RESEARCH STUDIES on the working of joint consultation will be the subject of a series of lectures on "The Human Factor" organized by the Department of Industrial Administration at Birmingham College of Technology early next year.

MORE THAN 350 people attended the annual "olde tyme ball" of Rolls-Royce Welfare Athletic Club, at the King's Hall, Derby, on November 28. Among those present were the Mayor and Mayoress of Derby (Councillor and Mrs. T. Dennis), Mr. F. Johnson (assistant works manager), and Mr. W. T. Gill (financial director).

ONE HUNDRED foundry workers employed by Sheepbridge Stokes, Limited, Chesterfield, have been declared redundant, their notices to take effect on December 5. Recession in the motor-car industry is given as the reason for the redundancy, as the firm, which employs approximately 900 workers, manufactures cylinder liners for car engines.

AT THE MEETING of the Council of the Institute of British Foundrymen, a recommendation by the literary and awards committee was unanimously approved that diplomas be awarded to Mr. G. W. Nicholls and Mr. D. T. Kershaw, B.Sc. for the Paper "System of Studying Casting Defects," presented at the Newcastle conference and subsequently at branch meetings of the Institute.

MR. W. NORRIS WINN, governing director of W. Martin Winn, Limited, and a member of the Midland-area training committee of the Iron and Steel Federation, has introduced "Training Within Industry" into the Darlaston area for the first time. A T.W.I. course began at the Darlaston factory of his firm on November 24 and representatives from several firms in the Darlaston and Walsall districts took part. The course occupies two hours a day for a week.

LIGHT CASTINGS (PTY.), LIMITED, of Boksburg, South Africa, have recently doubled their floor space and installed new machinery to meet their expanding production. The latter includes a British Moulding Machine model B.T.5, which is the only one in the country. They have also installed a new Broom-Wade compressor, a new August-Simpson sand-conditioning plant and numerous small machines. This firm makes any type of light casting to customers' specifications; their production covers a very wide range.

EMPLOYEES of Rubery Owen & Company, Limited, Darlaston, which firm recently bought the B.R.M. Car Trust, may have the opportunity to drive one of the cars if they are brought to the Midlands, Councillor A. G. B. Owen, chairman and managing director of the firm and former chairman of the Trust, said at their sports and social club dinner on November 24. The cars, he said, now belonged as much to the employees of Rubery Owen as to anyone else, and if, as he anticipated, at least one of the cars would be coming to Darlaston, employees with driving licences may be allowed to drive it to "see what it is like."

HOUSEWIVES have become "astonishingly technical" during recent months in their knowledge of solid-fuel domestic appliances. This fact was commented upon by Mr. W. S. Shirra, chairman of the Distributors of Builders' Supplies Joint Council and divisional director of Rowe Bros. & Company, Limited, Birmingham, in announcing that the demand for the all-night burning type of economy fire showed a big increase over the corresponding period of last year. "So far as this firm was concerned," he said, "we supplied in Birmingham alone nearly 1,300 such fires during October, compared with 605 during the same month last year."

AT THE ANNUAL DINNER of the Birmingham Engineering Society on November 19, Professor H. F. Humphreys, vice-chancellor of Birmingham University, forecast that in 30 yrs. more than 90 per cent. of the leaders of British industry would be drawn from university graduates. Whether it was a good thing he did not know. It was a state of affairs forced on universities by the Education Act of 1944. The network of university scholarships was now so widely cast that very few intelligent boys were passing direct from school into industry. Professor Humphreys said he had been struck by the rapid rise in the percentage of graduates in the membership of the various institutions of engineers. For civil engineers, the figure was 60 per cent. and he felt sure it was about the same for other engineers. He did not believe industrialists yet realized the extent to which universities, particularly in the applied-science departments, were drawing off that reservoir of talent they have relied on in recruiting their managers and technicians.

Obituary

THE DEATH last Thursday of Mr. R. C. D. Eveson, secretary, Eveson Bros. (1928), Limited, Lye, near Stourbridge, is announced. He was a member of the Institute of Vitreous Enamellers.

THE DEATH occurred in hospital on November 23 of MR. WILFRED SUMMERSCALES BARKER, head of the firm of Leach & Thompson, Limited, brass founders, Park Street, Keighley. Mr. Barker, who was 47 years of age, joined the firm in 1939.

MR. ROLAND FINCH, president of the International Conference of Non-Ferrous Metal Manufacturers from 1946 until last June and, until his retirement in 1946, a joint managing director of I.C.I. Metals Division, died in a Birmingham hospital on November 24. Born in 1882, Mr. Finch joined Kynoch, Limited, in 1902 as an assistant to the general manager, after graduating in mechanical engineering at the City and Guilds of London College. He was the company's foreign representative from 1906 to 1914 and from 1914 to 1918 was labour manager for all the Kynoch factories. When the King's Norton Metal Company, Limited, and the Birmingham Metal & Munitions Company, Limited, were absorbed, Mr. Finch became commercial manager of the metals department, and in 1929, when Elliot's Metal Company, Limited, and British Copper Manufacturers were merged with Kynochs, he became sales manager of the combined metals department. In 1938, he was made a director of Steatite & Porcelain Products, Limited, and in 1942 became its acting chairman. He was also chairman of Marston Excelsior, Limited. On his retirement, Mr. Finch joined the staff of the British Non-Ferrous Metals Research Federation in which he was already serving as a member of the council. Ill-health caused him to relinquish these duties last June. He was a former member of the grand council of the Federation of British Industries.

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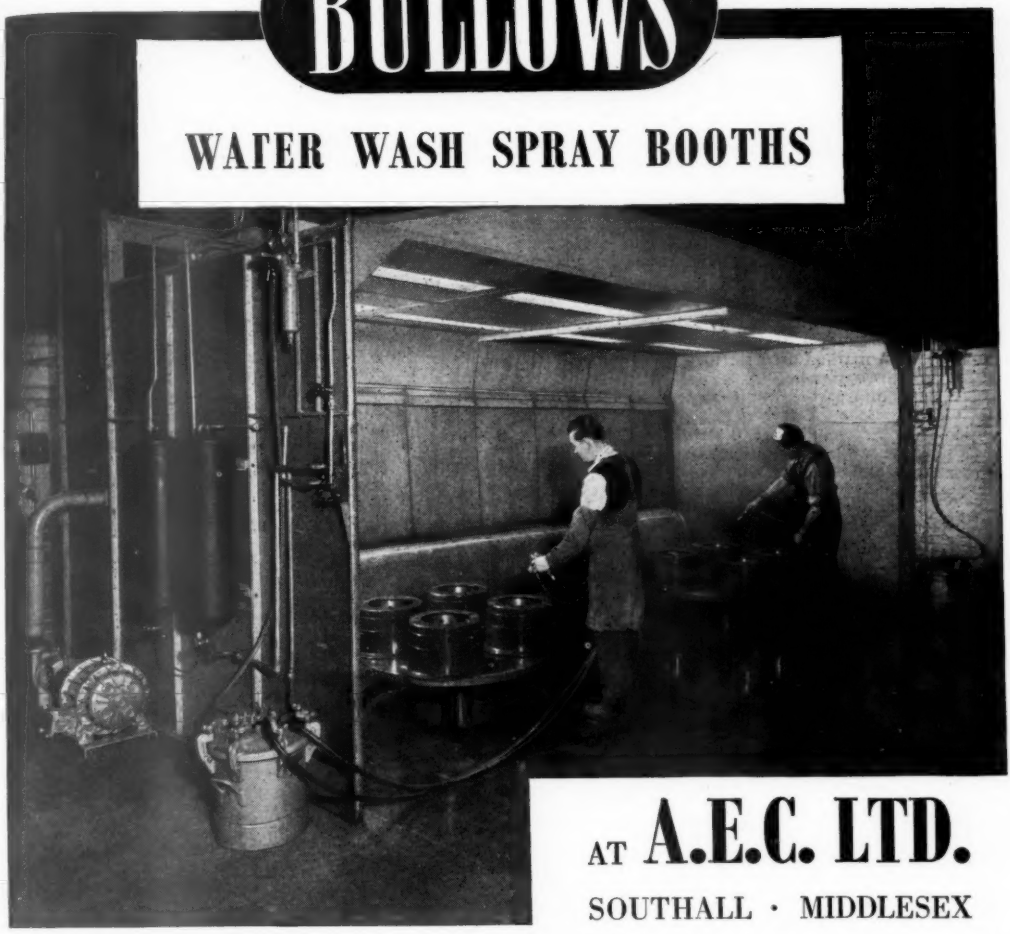

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Raw Material Markets

Iron and Steel

The reduced activity in the ironfoundry industry continues, and is the result of declining trade at home and abroad in several industries. The motor, tractor, and allied trades have been calling for fewer castings from the engineering foundries since a number of oversea markets were closed to them, and the foundries associated with the textile machinery industry, as well as the light foundries producing castings for domestic equipment, are alike affected by the recession in trade. Restrictions in hire purchase at home for such articles as refrigerators, washing machines, electric stoves, and gas cookers are curtailing demands. The jobbing foundries in turn experience a slackening in the demand for castings.

Overall production of castings is reduced and some foundries have been forced to cut their working week, while others have found it necessary to suspend some of their operatives. The situation at the foundries now shows a marked contrast to the position applying a few months ago, when all were heavily engaged and their only difficulty in obtaining maximum outputs was the shortage of raw materials. The arrears of orders which resulted have been cleared, and production is now dependent on day-to-day bookings. A fair amount of work is still being placed, and, fortunately, many establishments are well employed, depending on the type of castings produced, but more business is needed all round.

Record outputs of pig-iron continue to be achieved. Of the furnaces in blast, 60 are engaged on the production of basic pig-iron, 26 on foundry and forge grades, and 13 on hematite. The increased supplies of basic pig-iron now reaching the steelworks enable them to continue their record-breaking outputs, as the October results show, and the shortage of scrap will necessitate a continuance of deliveries at or above present levels if the steel industry is to work to capacity. Deliveries of scrap from home sources have been encouraging, and there has been a slight improvement in imported material, but even so the supply for the steelworks is inadequate and the prospects of obtaining larger quantities are not good.

The foundry grades of pig-iron are about sufficient to cover the reduced demands, although there is no large surplus after current needs have been satisfied. The engineering foundries are taking up all the low- and medium-phosphorus iron and hematite which is available. The present supply of high-phosphorus pig-iron about covers the reduced quantities required by the foundries. The position may be different at the end of the year, when more furnaces come into operation. Unless trade improves for light castings, there may be more pig-iron than is required, but it is not thought that makers will be permitted to stock any considerable amount, or allowed to export on any scale. What may happen if too much high-phosphorus pig-iron is produced, is that the furnaces will be put on pig-iron for the steelmakers, in order to cut down the tonnage of basic iron which is being imported.

There are still a few idle steel furnaces, but melting shops are turning out much bigger tonnages of ingots, and this has given a decided impetus to rolling-mill activities. Next to the sheet trade, the most clamant call is for plates, both for home use and for export. Large quantities of light plates are required for armament work and requirements of the shipbuilding industry can only be partially covered. Requisitions for colliery material in the form of bars, arches, and rails are maintained at a high level and the relaxation of restrictions upon capital equipment promises a still heavier demand for constructional steel.

Non-ferrous Metals

It is a little difficult to understand why there should be a certain amount of bearish talk about the prospects for the copper price over the next few months, unless this is due to the falling off in demand for semis on this side of the Atlantic, for conditions on the Continent are far from brisk. It may be noted, too, that copper scrap, in this country at any rate, is now showing a somewhat firmer tendency. If the level of virgin copper were determined in the U.K. on the London market, then it seems likely that there would be a marking down of values at present, but so long as it is the U.S. quotation that fixes the price at which the Ministry sells to British consumers, a fall in the near future appears to be unlikely. In this connection the October statistics of copper activity in the United States are enlightening, for they reveal a condition of affairs which is the reverse of discouraging. Blister copper output in October was 84,353 short tons, an advance of about 2,000 tons, while refined production amounted to 105,770 tons, compared with 98,930 tons in September. Domestic deliveries totalled 136,964 tons, about 1,500 tons up on the previous month. Refined copper stocks in producers' hands at October 31 were 59,760 tons, which compared with 71,456 at the end of September.

The Ministry has announced a reduction in its buying price for rough copper from £235 to £200 per ton.

Lead prices staged a recovery last week, when there was a moderate turnover. Consumers are still buying cautiously, being apparently disinclined to follow any rise in the price of the metal, however moderate it may be. On the New York Commodity Exchange both zinc and lead futures were rather firmer, but whether this is due to special support by interests who wish to keep up the average price is a matter for conjecture. The E. & M.J. copper quotation, made up to the middle of last week, showed some advance, being a few points below 35 cents on a f.a.s. basis.

Official lead prices were as follow:—

November—Thursday, £91 15s. to £92. *December*—Friday, £94 to £94 5s.; Monday, £92 15s. to £93; Tuesday, £93 5s. to £93 10s.; Wednesday, £94 to £94 5s.

February—Thursday, £91 10s. to £91 15s. *March*—Friday, £94 to £94 5s.; Monday, £92 15s. to £93; Tuesday, £93 5s. to £93 10s.; Wednesday, £94 to £94 5s.

Tin was again a very quiet market. The principal feature was a narrowing of the backwardation. Stocks in official Metal Exchange warehouses are, however, still much lower than they ought to be to ensure a proper balance between the spot and forward quotations.

Official tin prices:—

Cash—Thursday, £962 to £963; Friday, £958 to £959; Monday, £951 to £952; Tuesday, £950 to £951; Wednesday, £955 to £956.

Three Months—Thursday, £945 to £946; Friday, £942 10s. to £943; Monday, £942 10s. to £943; Tuesday, £944 10s. to £945; Wednesday, £945 to £945 10s.

OF THE 2,000 EMPLOYEES at the Coombs Wood (Worcs) works of Stewarts and Lloyds, Limited, 898 have qualified for long-service awards. Sixty-two have completed over 50 years' service, 230 between 40 and 50 years, and 600 between 30 and 40 years. The total service of the recipients of recently presented awards amounted to almost 34,000 years.

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Illustrations of Supinex "R" in use by courtesy of Messrs. S. A. Rhodes, Ltd. Hyde, Cheshire.

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AN ENTI ELY NEW TYPE OF BINDER, STARTLING IN ITS PERFORMANCE—

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Free working samples gladly supplied on request.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

December 3, 1952

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 1s. 6d.; Birmingham, £12 15s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £16 8s., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £15 5s. 9d.

Scotch Iron.—No. 3 foundry, £15 19s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 14s. 6d. South Zone, £17 17s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £18 14s. 6d.; South Zone, £18 17s.

Cold Blast.—South Staffs, £18 2s.

Hematite.—Si up to 2¼ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £16 2s.; Scotland (Scotch iron), £16 8s. 6d.; Sheffield, £17 3s.; Birmingham, £17 9s. 6d.; Wales (Welsh iron), £16 8s. 6d.

Basic Pig-iron.—£13 19s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45% Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75% Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 22s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204; ditto, copper-free, £212.

Ferro-tungsten.—80/85 per cent., 27s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 30s. 8d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60% Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s., basis 60% Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr; max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 6s. 9d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £49 0s. 8d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 40s. to 60s. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £31 9s.; case-hardening, £31 17s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £31 17s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £41 12s. 6d.; galvanized corrugated sheets, 24 g., £52 9s.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 7s. 9d.; nickel-chrome-molybdenum, £79 2s. 6d.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £955 to £956; three months, £945 to £945 10s.; settlement, £946 10s..

Zinc.—G.O.B. (foreign) (duty paid), £110; ditto (domestic), £110; "Prime Western," £110; electrolytic, £114; not less than 99.99 per cent., £116.

Lead.—Refined pig-lead: November, £94 to £94 5s.; February, £94 to £94 5s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £130 15s.; rolled zinc (boiler plates), all English destinations, £128 15s.; zinc oxide (Red Seal), d/d buyers' premises, £136.

Other Metals.—Aluminium, ingots, £166; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £70 10s. to £71 nickel, £454.

Brass.—Solid-drawn tubes, 26½d. per lb.; rods, drawn, 37d.; sheets to 10 w.g., 31⅛d.; wire, 32⅞d.; rolled metal, 29⅝d.

Copper Tubes, etc.—Solid-drawn tubes, 32⅛d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £195 to £218; BS. 1400—LG3—1 (86/7/5/2), £207 to £238; BS. 1400—G1—1 (88/10/2), £320 to £375; Admiralty GM (88/10/2), virgin quality, £335 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £350 to £385; L.P.Bl, £250 to £275 per ton.

Phosphor Bronze.—Strip, 44d. per lb.; sheets to 10 w.g., 46½d.; wire, 49⅝d.; rods, 44½d.; tubes, 42⅝d.; chill cast bars: solids 4s. 2d., cored 4s. 3d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 9½d. per lb. (7%) to 3s. 10½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 3½d. (7%) to 4s. 4½d. (30%); to 12 in. wide × .056, 3s. 3½d. to 4s. 4½d.; to 25 in. wide × .056, 3s. 5½d. to 4s. 6½d. Spoon and fork metal, unsheared, 3s. 0½d. to 4s. 1½d. Wire, 10g., in coils, 3s. 9½d. (10%) to 4s. 10½d. (30%). Special quality turning rod, 10%, 3s. 8½d.; 15%, 4s. 2d.; 18%, 4s. 6½d. All prices are net.

Personal

H.R.H. THE DUKE OF EDINBURGH has accepted election to honorary membership of the Institution of Mining and Metallurgy.

MR. GEORGE DUNBAR has been appointed to the directorate of John Fowler & Company (Leeds) Limited. He joined the company in 1950 as commercial manager.

MR. FRANK SHEPHERD, personnel manager of Head, Wrightson & Company, Limited, engineers and ironfounders, etc., of Thornaby-on-Tees (Yorks), has been appointed a magistrate for the North Riding.

MR. ROBERT HOLMS, foreman patternmaker, has retired after 35 years with the Reid Gear Company, Limited, Linwood, Renfrewshire, and has been presented with a wallet of notes from employees and staff.

MR. E. LONGDEN, vice-president of the Institute of British Foundrymen, returned home this week after a protracted stay in Jugo-Slavia where, on behalf of the United Nations Technical Aid Mission, he has been acting as consultant to the Jugoslav Government on foundry matters.

MR. H. S. BRUCHSHAW, director of Chatwood Safe & Engineering Company, Limited, Shrewsbury, who was chairman of the Shropshire Engineering Employers' Association from 1944 to the present year, was recently presented with an antique silver salver in appreciation of his outstanding services to the Association. Mr. J. W. Taylor, director of Audley Engineering Company, Limited, Newport, who has this year succeeded Mr. Bruchshaw as chairman, made the presentation.

A NEWLY-ELECTED member of the governing body of the International Labour Organization to succeed the late Sir John Forbes Watson is SIR RICHARD SNEDDON, general manager of the Shipping Federation. Sir Richard, who graduated at Edinburgh University, was called to the Bar in 1925. He joined the staff of the National Confederation of Employers' Organizations in 1923 and was joint secretary of the British Employers' Confederation until 1929, when he joined the Shipping Federation as assistant secretary. He became secretary in 1933 and general manager in 1936.

DR. J. E. HURST, D.Met., managing director and deputy chairman of Bradley & Foster, Limited, Darlaston, was honoured last week-end by a presentation ceremony at the works to mark his completion of 25 years' service with the company. Dr. Hurst's technical attainments are well known, and making presentations at this ceremony attended by directors, executive, and workpeople, Mr. T. A. McKenna, chairman of the company, and of the parent company, Staveley Coal & Iron Company, Limited, spoke of his great service to the company since succeeding the late Mr. Talbot Lunt. Mr. McKenna presented Dr. Hurst with a certificate citing his service with the company, a special clock and three silver salvers, two of which contained the fellow directors' signatures. Thanking the assembly, Dr. Hurst said it was a matter of considerable pride to all that Bradley & Foster had grown so considerably during those years. When they took over it was a derelict organization, and it had now grown to something that mattered in the whole field of ironfounding and metallurgy.

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CLASSIFIED ADVERTISEMENTS

PREPAID RATES : **Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Number 2s. extra (including postage of replies).**

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, 49, Wellington Street, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY METALLURGIST, age 34 (H.N.C.), seeks progressive position in modern steel foundry laboratory. Converter and basic electric experience; full control; good references.—Box 3132, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (40) requires similar position with progressive company. Experience covers all foundry operations. Fully accustomed floor moulding and mechanisation.—Box 3137, FOUNDRY TRADE JOURNAL.

FOUNDRY EXECUTIVE desires change. Seeks position as Foundry Manager or similar post. Sound practical and technical experience. Patternmaking, moulding, coremaking. Modern methods. Accustomed to full control. M.I.B.F., A.M.I.Prod.E.—Box 3136, FOUNDRY TRADE JOURNAL.

MANAGER (45), practical foundryman, with estimating, costing and commercial experience, desires change to more progressive company. Previous positions. Full control of heavy and medium jobbing foundries, mechanised plant and Sandslinger production, some knowledge of enamelling processes. Must be interesting and progressive position. Available short notice. Box 3120, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952.

LEAD REFINING.—SHIFT FOREMAN required. Energetic and general knowledge of Lead Refining operations and capable of labour supervision. (Present employees informed of advert.)—Full details, experience, salary required, etc., Box 3116, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT, aged 35-40, required by North-East Coast Engineering Company. Duties include co-ordination of planning and administration of all the company's foundry activities, and the supervision of production of C.I., bronze and steel castings in their modern foundry.—Send full details training and experience to Box 3093, FOUNDRY TRADE JOURNAL.

REPRESENTATIVE required by Brush Manufacturer, already calling on engineering and allied trades. Only gentleman with established connections, large engineering works, etc. Please write stating area and lines carried. Good commission paid promptly.—Box 3119, FOUNDRY TRADE JOURNAL.

ASSISTANT to Chief Metallurgist required by well-known Midland Malleable Ironfounders.—Apply, stating age, experience and salary required, Box 3124, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY FOREMAN required. Applicants should state previous experience, position held, and wages required.—Apply in writing to JAS. SMETHURST & SON, LTD., Warrington.

EXCEPTIONAL opportunity for keen, conscientious, and fully experienced FOUNDRYMAN to become Partner in private Company of Ironfounders. Full control given on proved results. Minimum capital required £1,000, maximum £5,000. State fullest details of all experience in confidence. This offer is sound; only genuine persons capable of holding responsibility need apply. Attach copies of three references.—Box 3122, FOUNDRY TRADE JOURNAL.

DRAUGHTSMAN required, age 21/25, with sound workshop experience, preferably with some experience of foundry practice. The duties involve detailing, design and weight calculation of castings. Salary in accordance with qualifications and experience. Pension and bonus schemes in operation.—Applications should include full details of previous positions and when available to A.P.V. PARAMOUNT, LTD., Manor Royal, Crawley, Sussex.

FOREMAN-MANAGER required for small Non-ferrous Foundry Department, Sheffield. Sound all-round technical knowledge essential; also a progressive outlook upon the importance of good working conditions and high productivity. Room for considerable expansion.—Write in first instance, stating age, experience, and salary required, to A. G. WILD & Co., LTD., Charlotte Road, Sheffield.

EXPERIENCED FOUNDRY FOREMAN required in the Burnley area of Lancashire to take full charge of Ferrous Foundry. Plate and loose pattern work up to 20 cwts.—Reply, stating age experience, to Box 3135, FOUNDRY TRADE JOURNAL.

ENGINEERING Firm in the West of Scotland invite applications from foundrymen about 35 years of age for the position of FOUNDRY MANAGER. The foundry, which has both loose pattern and mechanised sections, has a present output of 120 tons per week, and this is likely to expand. The firm has a pension fund and life assurance scheme. Applications should state age, qualifications, experience, and salary required.—Box 3133, FOUNDRY TRADE JOURNAL.

SUPERINTENDENT required for Foundry in General Engineering Works. Castings all weights to 12 tons, output 50 tons per week. South Staffs. area. Applicants must have general experience in floor and machine moulding and control of labour.—Write, giving details, to Box 3084, FOUNDRY TRADE JOURNAL.

NON-FERROUS FOUNDRY MANAGER for a modern well-equipped Foundry in the North-East of England. Must be fully experienced. A good salary will be paid, with the likelihood of a Directorship after completion of a satisfactory probationary period.—Apply Box 3106, FOUNDRY TRADE JOURNAL.

FOREMAN for Light Alloy Die Casting Section required by firm in the Falkirk area.—Write, stating qualifications, salary required, when available, etc., to 22NO, WM. PORTEOUS & Co., Glasgow.

REQUIRED, for Ferrous and Non-ferrous Foundry in East Anglia, ASSISTANT SUPERINTENDENT. Applicants should have a good technical and practical background, and be able to supervise. A progressive and well paid position for right man.—Apply, giving qualifications, experience, and salary desired, in first instance to Box 3127, FOUNDRY TRADE JOURNAL.

ENERGETIC man required for the Production Department of a large Steel Foundry. The post calls for a wide knowledge of steel foundry practice and method, ratefixing, ability to control and co-ordinate the work of the team, and a real appreciation of the problems of both sales and service are considered essential qualifications.—Reply, giving details of education, positions held, and salary required, to Box 3126, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required by a leading Manufacturer of Plumbers' and Engineers' Brassfoundry situated in Birmingham. Foundry is modern and semi-mechanised, and the applicant must have the ability to maintain production, control labour, and possess a thorough practical and theoretical knowledge of the trade.—Box 3130, FOUNDRY TRADE JOURNAL.

MANAGING DIRECTOR of Ironfounders and Engineers in West Midlands requires TECHNICAL ASSISTANT. Applicant must have a thorough training in all departments of a modern foundry and be capable of taking control. Position offers considerable scope to a man with the necessary qualifications. A good salary is offered.—Write, stating age, experience, etc. Our own staff are aware of this vacancy.—Box 3131, FOUNDRY TRADE JOURNAL.

K. & L. STEELFOUNDERS & ENGINEERS, LTD., Letchworth, Herts., have a vacancy for a young METALLURGIST for technical control and development duties in their Laboratories and Foundry. Applicants should be in the 22/27 age group and of graduate or equivalent educational status. Foundry experience, whilst desirable, is not essential—more important qualifications being personality and a keen interest in steel founding.—Replies, detailing age, education and experience, together with an indication of salary required, should be sent to the PERSONNEL SUPERINTENDENT at the above address.